Journal

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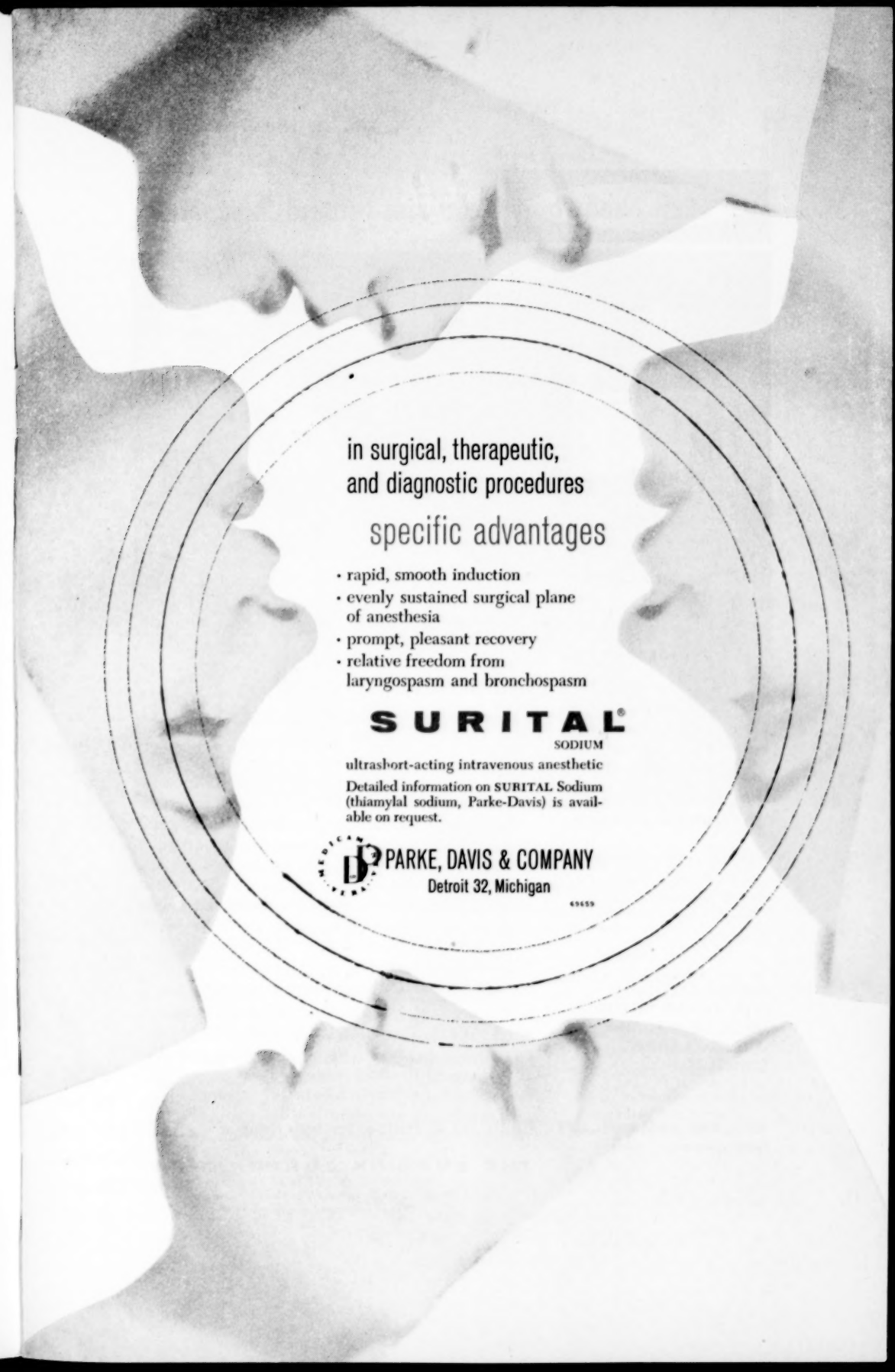
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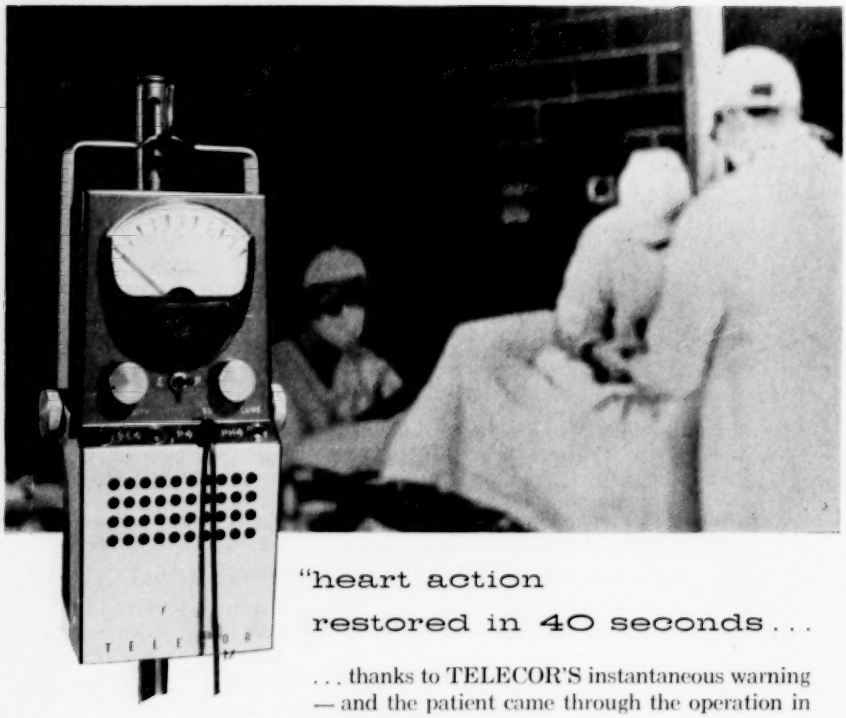

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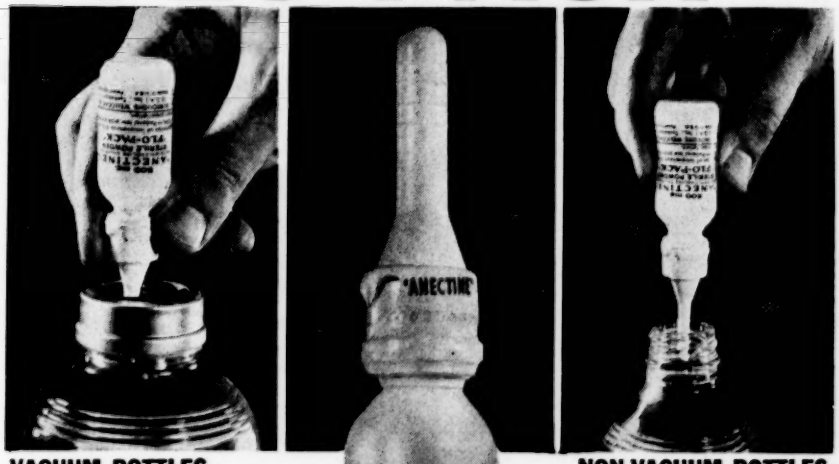

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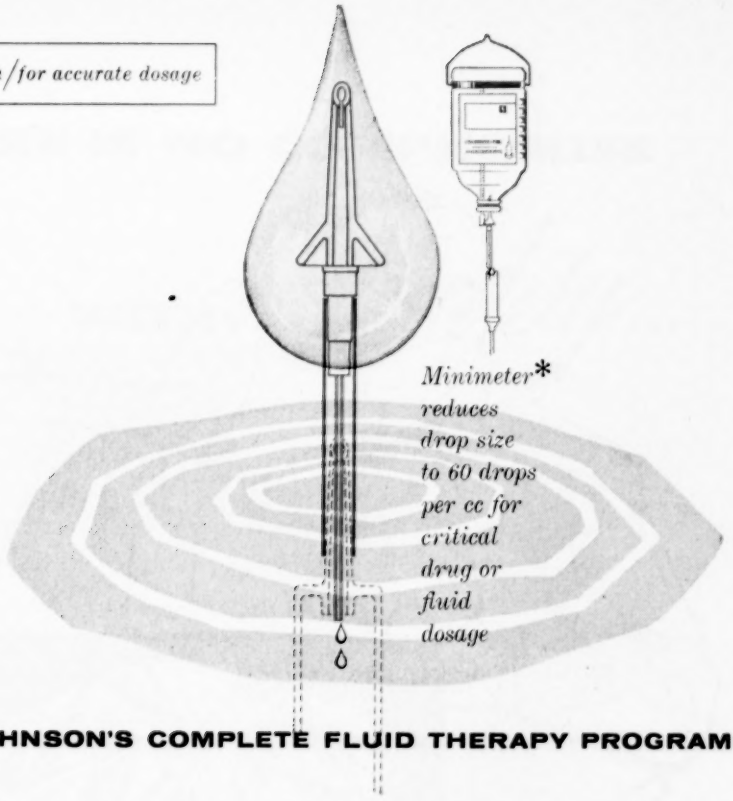

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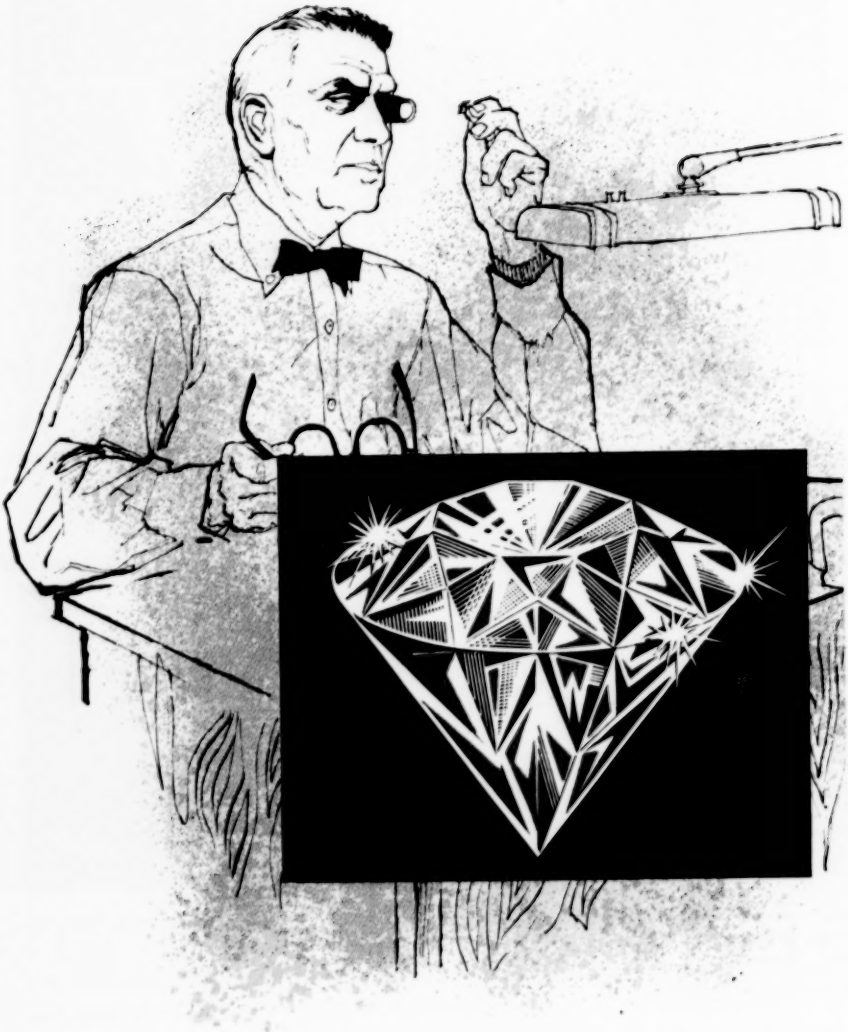

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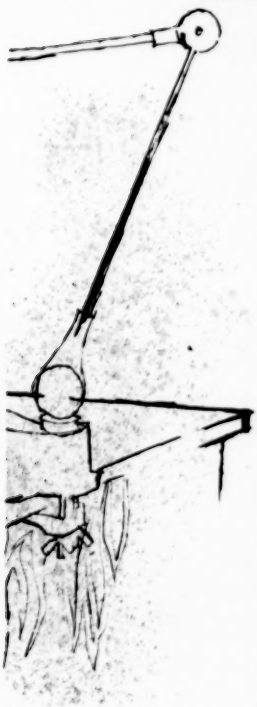

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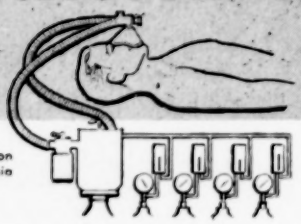

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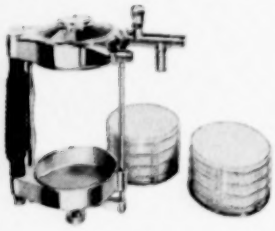

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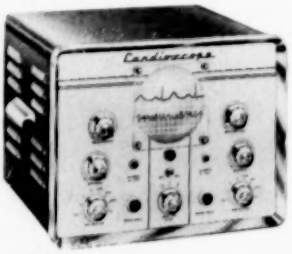

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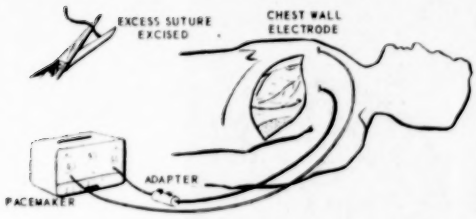
an electrically conductive cardiac suture

*Edward A. Fitch, M.D.**



The necessity for applying an artificial stimulus to the heart to evoke effective ventricular contractions arises occasionally. Usually these incidences occur at critical times, and the patient's survival depends on the efficacy of the artificially stimulated contractions.

This resume is confined to the discussion of those syndromes in which ventricular myocardial contractility is adequate and the primary defect is the absence of a stimulus of sufficient frequency and/or intensity.

An intermittent electrical impulse is the most reliable type of artificial stimulus. Several "pacemakers" are commercially available. The electrodes can be applied externally at two points on the chest wall and the stimulus increased in intensity until a perceptible pulse synchronous with the pacemaker rhythm indicates that the ventricles are responding. Electrodes can be applied internally via a thoracotomy incision, and the response further evaluated by direct vision.

There are several difficulties. The external electrodes cause spasmodic contractions of all skeletal muscle within their field, as well as myocardial tissue. The resultant artificial clonic local convulsion soon becomes intolerable to the conscious patient, and severely handicaps observation and examination of the critical patient.

When peripheral vascular hypo or hypertonia renders pulses imperceptible, the effectiveness of the electrical stimulus is open to question. With a thready pulse and jerking chest musculature, one is never sure (in the closed chest) at what point an increasing intensity is sufficient to stimulate the myocardium.

An open chest facilitates evaluation of the heart beat by direct vision. However, it is axiomatic that the sooner the wound is closed, the better. Closure of the incision while the external electrodes are in operation is clumsy and difficult.

**Public Health Service Research Fellow of the National Heart Institute*

Many of the above problems have been solved by the application of a wire electrode directly to the myocardium. Such an apparatus is now commercially available. A silver wire is doubly armed with swaged needles, one curved and one straight. The entire wire is insulated with a polyvinyl sheath, except for the four inches adjacent to the curved needle. The surrounding insulation is swaged into the straight needle. The suture is supplied in sterile packets ready for use.

A single stitch is taken in the ventricular myocardium with the curved needle and the bare wire pulled through until the polyvinyl insulation encounters the muscle. The needle is then cut off leaving a 1-2 cm. length of wire protruding. This can be secured with a 5-0 stitch if desired.

A spot on the chest wall is then chosen for the penetration of the straight needle. This should be away from the incision edges so it will not be dislodged during wound closure. It should be in such a location that the suture, when withdrawn from the chest, will pull out of the heart in the long axis of the wire, and not lacerate the myocardium by its sawing action in a right angle pullout. The straight needle is attached directly to the pacemaker attachment. Adapters are commercially available to joint all pacemakers with the conductive straight needle. The second (non-specific) electrode is applied externally to the right of the sternum, or, two internal suture electrodes can be utilized.

With such a scheme, one is confident that an effective stimulus is applied to the myocardium. The assurance should eliminate one variable for the multi-faceted problem of sustaining the critically ill patient.

***Note**: The cardiac arrest suture, the application of which is described in this article, is available from Ohio Chemical.*

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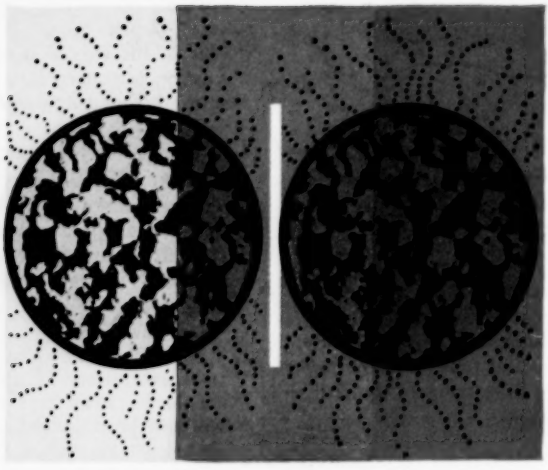

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Geriatric Anesthesia

E. George Beer, M.D.*

Oakland, California

The life expectancy of the American people over the past two hundred years has nearly doubled. Reference: *"Table 1"*. In consequence of this simple fact of vital statistics the proportion of old people among our patients has increased over the years and will continue to increase, even though the incidence of disease percentagewise might have been reduced during that period.

Life Expectancy at Birth

1776	35.5	years
1900	50	years
1950	68.2	years

(Barrett)
Table #1

The question before us is whether this increasing number of old people presents any special problems in the field of surgery and anesthesia. We realize that there is no sharp line dividing middle age from old age, just as there is a more or less fluid zone separating pediatric from adult medicine and surgery. Everybody will probably agree that at the age of 80 a patient belongs into the old age group; to include him in this group at age 55 might produce objections. Most authors draw the line at 60 or 65 years. Of course, this chronological age is more or less irrelevant for our purposes. What matters to us in estimating the possible response to operation and anesthesia is the "biological" age. Don't ask for a precise definition of this biological age — it does not exist. It is just a convenient expression to indicate that some people at 70 have the resilience of the normal 50 year old, while others at 50 years have no biological reserve left and respond like the average 70 year old person. It is our main task during the preoperative evaluation to estimate as accurately as possible this biological age.

Anatomy, Physiology and Pharmacology

The capacity to grow and to replace worn out cells is an essential feature of all living tissues and organs. Old age has arrived when the balance between wear and tear and the continuous replacement becomes disturbed, when regeneration lags behind degeneration not only in quantity, but also in quality. Connective tissue tends to replace the biologically active cells in the different tissues and organs. In some people this shift of the biological equilibrium occurs early in life, whereas in the more fortunate individuals it becomes noticeable at a much later date. While these degenerative changes progress, the ability of the tissues and organs to

* Chief, Anesthesiology Section, Veterans Administration Hospital, Oakland, California.

Presented at the Institute for Nurse Anesthetists, San Francisco, California, January 28, 1959.

withstand stress and damage decreases and the stress response may become inadequate. The functional ability of the organs as a rule is reduced more than their size and weight[55].

Let us now first review the so-called normal changes, which, as we already have pointed out, do not occur in all tissues and organs at the same time and to the same extent. The loss of intercellular and intracellular water is one of the dominating signs of aging, noticeable in the dry skin and the lost turgor of the subcutaneous tissues. The organic (or, if you prefer, living) component of the bone is reduced, leaving the now predominant mineral component more brittle, liable to fractures, and at the same time reducing the ability to repair such fractures. Cartilages and ligaments calcify, interfering not only with locomotion but, even more important to us, with the expansion of the chest wall during breathing. The alveolar processes of both jaws atrophy, causing the teeth to fall out, thus interfering with the uptake of solid foods and the nutrition of the individual. In addition, nutrition might be impaired by the inability or unwillingness of old people to provide for a well balanced meal. The atrophy and weakness of skeletal muscles is a well known sign of old age. The problem as to whether the inactivity of old age is the result or the cause of this muscle atrophy remains unanswered.

The changes of the liver and kidneys and their function in old age can be best described as atrophy, proliferation of connective tissue and decreased function[53]. The same applies to the endocrine glands. The decreased output of sexual hormones and the hypothyroid status with its lowered metabolic rate in old people are the best known examples of this lowered glandular activity. The functioning cells of the bone marrow are replaced by connective tissue and this explains at least in part the reduced output of red cells, which, in addition, have a lower hemoglobin content. The circulating cells are more fragile and, therefore, more easily destroyed — a prime example of the disturbed balance between cell death and cell replacement in old age and another factor that contributes to the anemia of old age. Schmidt and his associates[52] found a reduction of the red cell volume in otherwise healthy old men, while the mean blood and serum volumes in both sexes did not materially differ from younger age groups. May I, however, add that in our work it is safer to proceed under the assumption that hemoconcentration and a reduction of the circulating blood volume should be expected in most old people.

The changes in the nervous system due to the gradual loss of nerve cells include impaired memory, slowing of the reflexes, fatigue after minor exertion, impaired heat regulation and a dulling of all sensations, that might contribute to burns and pressure sores that we see all too frequently.

The replacement of high quality tissues by connective tissue in old age is particularly remarkable in the cardiovascular system. The elastica of the arteries is gradually replaced by connective tissue, calcium is deposited in the intima with the resulting inability of the myocardium and the arteries to adapt themselves quickly, if at all, to the changing needs of the tissues and organs. The heart muscle

atrophies and the cardiac output is reduced. This, and the increased arterial rigidity, lead to impaired blood supply and oxygenation, especially in the periphery, the brain and the myocardium.

Of particular interest to us, of course, are the "normal" changes of old age in the respiratory system. They can best be described as increasing senile emphysema with a reduction of the tidal volume and the vital capacity and the ensuing difficulties to maintain adequate tissue oxygenation and, at a later stage, to eliminate CO_2.

All these gradual changes of normal old age will impair the ability to maintain hemeostasis, to provide a prompt and adequate adjustment of the vital functions to stress of any kind and, at a later stage, even to the normal stresses of every day living.

However, most patients at this age in addition show changes connected with disease or diseases, which may or may not be related to the condition that requires surgical intervention. More about these changes later. At this point we simply state that they will require our special attention before, during and after operation, and that the normal and pathological changes of old age increase the sensitivity to oxygen lack, carbon dioxide accumulation, dehydration, blood loss, excess hydration, infection and lack of essential metabolites like protein, minerals and vitamins.[31]

The reduced metabolic rate and diminished glandular activity, especially in the liver and the kidneys, modify the response to all drugs and especially to analgesics and anesthetics. Drugs will be more slowly detoxified and excreted, and this is one of the reasons why these drugs have so much more profound effects for a much longer period, even in the absence of any pathological condition. On the other hand there is delayed absorption from the gastrointestinal tract and from the subcutaneous tissues as well as impaired diffusion across the pulmonary epithelium. All these factors will, therefore, delay the onset of drug effects and, in the case of inhalation anesthesia, delay induction and emergence with all the hazards that such a delay involves. Beecher, several years ago, described the delayed absorption of morphine in severely wounded men in shock from subcutaneous or intramuscular depots; a similar delay should be anticipated in old people, and it is much safer and more effective to administer drugs intravenously at a very slow rate until the clinical effects become noticeable.

How do the physiological and pathological changes of old age influence the conduct of anesthesia? The impaired homeostasis obviously reduces the margin of safety for these old people, and the surgeon and anesthetist have very little time to correct any complications that might develop. Uninterrupted attention to the least details of the procedure is, therefore, even more imperative than in younger and healthier people. Any abnormality that is at all amenable to therapy should be corrected before, rather than during, the surgical procedure.

Preoperative Evaluation

This is one of the reasons why old people even more than younger ones should be thoroughly studied and evaluated preoperatively. This is one of the advantages work with a physician anesthetist will have for you; he will assume that task for you and

relieve you at least from this responsibility. You should, on the other hand, insist on a minimum of preoperative studies whenever you work alone, regardless of the planned surgical procedure. There may or may not be such a thing as minor surgery, but there is never at any time a minor anesthetic procedure!

You will have to rely on the surgeon or on a house officer to obtain an adequate history. Never hesitate, however, to inquire yourselves about previous anesthetic procedures and possible anesthetic and postanesthetic complications. Ask about asthma attacks and other allergic responses, especially to drugs; remember the vagal effects of barbiturates, especially the thiopental group, that might precipitate an asthmatic bronchospasm, and be prepared to treat it. Don't ever rely on the surgeon or any other person, who tells you that the patient has not eaten recently. Inquire in detail when the last liquid or solid food was t a k e n , what type and what amount. We, incidentally, have repeatedly come to grief, not only with emergency patients but also with psychiatric patients and confused old people, who helped themselves to a meal, despite a sign "NOTHING BY MOUTH" on the bed. I realize that questioning in this kind of patient will not always elicit a truthful answer, but I would still try to find out. Where surgery cannot be delayed, the stomach should be emptied with a large bore tube or a dose of apomorphine large enough to produce vomiting. The possibility of a tear in the stomach or the esophagus is remote, the chance of a fatal or near fatal aspiration of gastric contents very real.

It is important for you to find out for yourselves whether your patient has recently received any drugs for any length of time. So many old people receive continuous medication for high blood pressure or for emotional disorders today. Hexamethonium is still used for hypertension, although the rauwolfia derivatives are more frequently encountered in patients with this condition; the members of the chlorpromazine and phenothiazine family as well as meprobamate are used as tranquilizing agents. All may potentiate the sedative effects of our usual preoperative medication and may lead to prolonged and profound depression of the respiratory system as well as to severe hypotension. It is mandatory in patients of this type to reduce the dosages of all pre- and postoperative analgesics and hypnotics as well as the amount of drugs you use for general anesthesia, unless it is possible to discontinue the use of hypotensive and tranquilizing agents well ahead of the operation.

The effects of cortisone and many related steroids from the adrenal cortex have been described in the literature. Although they are more frequently used in younger people, there will be an occasional old patient who has been on maintenance doses for a long period of time. Watch out for this, especially in sufferers from severe, crippling arthritis or asthma. We increase these maintenance doses or reinstitute cortisone therapy in all patients who have received this drug for more than one week during the preceding nine months, even for so-called minor surgery. Our usual dosage is 200 mg. cortisone in divided doses one or two days before and on the day of surgery. The dosage will then gradually be reduced to the old

maintenance level or discontinued as the patient's condition and blood pressure permit. In emergencies the drug can be given intravenously. Failure to prepare these patients, whose own output of adrenal cortical hormones has been suppressed by the prolonged administration of cortisone, may lead to severe and irreversible shock that will not respond to vasopressor drugs or blood transfusion.

Adequate preoperative evaluation includes a physical examination of the whole patient and you will, of course, accept the findings of the patient's physician as recorded on the chart. That a urinalysis forms an essential part of any physical examination should not be mentioned before this group; unfortunately, far too many patients for either minor or emergency surgery arrive in the Operating Room without a report of their urinary findings. I know of one table death during a circumcision in a young diabetic unable to void. A catheterized specimen was not obtained because the surgeon did not want to "waste time", the patient insisted on general anesthesia without informing anybody about his condition and his insulin dosage. An order to proceed was not entered by the surgeon into the clinical record, and everybody concerned says now the anesthetist is at fault! So, for your own protection, insist on a written order to proceed in any such case, and have this order, in the case of a house officer, confirmed by a senior physician. It is most amazing to observe the reluctance that develops in the most impatient operator after you request a written statement that would permanently fix his responsibility.

In the presence of diabetic (or any other) severe acidosis and high blood sugar levels, anesthesia and surgery are usually contraindicated, except for the most urgent lifesaving procedures. Massive doses of insulin will be needed to control the disturbance, and the electrolyte imbalance, especially the potassium loss, need correction if you want to give the patient a fair chance for survival. In elective surgery, adequate time should be allowed to restore the depleted glycogen depots of the liver and to control the diabetes with the blood sugar level as close to normal as possible. The morbidity and mortality of well-controlled diabetics compare favorably with the average rates for their age group, unless irreversible vascular changes have added a risk of their own; the figures for uncontrolled diabetics are forbidding. It is important to remember that some of the so-called depot insulins show their effect for more than 24 hours. A fasting patient may, therefore, go into hypoglycemic shock unless you protect him with intravenous 5% glucose in the morning before or during surgery. We prefer, whenever possible, to have the patient controlled with "regular" insulin according to the rainbow scheme on the day of surgery as well as the preceding day. In a well controlled diabetic, we are more concerned with the avoidance of hypoglycemia than with a mild spill of urinary sugar.

We ask for a chest x-ray and an electrocardiogram as part of our preoperative study in older patients. The ECG may or may not substantiate a history of a previous coronary occlusion or a myocardial infarct. We want it mainly as a base line for tracings that may be taken postoperatively.

Our medical friends can be of much more help to us in the reading of postoperative ECG's if such a preoperative tracing is available.

A chest film may show pulmonary or cardiac changes amenable to improvement by preoperative treatment. In addition, there might be shadows indicating the presence of primary or metastatic neoplasms. To avoid a painful elective operation in an old patient in the presence of such findings seems only common sense.

It would be highly desirable to have a simple and reliable method for estimating the cardiopulmonary reserve of our patients. Unfortunately, all known and useful methods require a well equipped physiology laboratory. Dyspnea or its absence at rest, or after minor exercise like walking a flight of stairs, or the ability to hold one's breath for a certain time (usually 15″) still remain the most reliable guides for the average anesthetist.

Let us now go back to another piece of laboratory work you would like to find in your patient's chart, the blood count. Unfortunately, a normal red count, hemoglobin and hematocrit, do not necessarily mean that all is well. Old patients, especially those who have perspired profusely or who have had diarrhea or who have vomited for some time, may have normal values in the presence of severe dehydration with a reduced total blood volume. A blood or plasma volume determination with Evan's blue or radioisotope tagged red cells or plasma would be most desirable. The methods are, however, not as easily applied as a routine blood count and the results will not be very helpful unless your laboratory performs these tests frequently and routinely.

We have found determinations of the serum protein and of the albumin-globulin ratio very helpful in estimating the patient's nutritional status and the need for additional feedings or blood transfusions before surgery. The electrolyte panel, including chlorides, sodium, potassium and others, is a particularly valuable guide in the preoperative evaluation and management of old people with intestinal obstruction, renal disease or cardiac failure, among other disorders.

A bleeding and clotting time is done routinely in many hospitals. Diamond's recent article[23] seriously doubts the value of this method in the detection and prevention of operative and postoperative hemorrhage. Diamond feels that a previous history of prolonged bleeding after minor injuries, dental extractions, etc., is much more significant.

Preoperative Therapy

It is an accepted and sound principle of good anesthesia and surgery to put a patient in the optimal condition before operation. It is much easier to correct deficiencies and abnormalities before, than during or after surgery. This applies even more in the older age group. A thorough preoperative evaluation will enable us to treat many complications before they might jeopardize the successful outcome of an operation.

Most important, of course, is the restoration of an adequate circulating blood volume and hemoglobin level.

Even in emergencies with massive blood losses the systolic pressure should be restored with multiple transfusions to about 2/3 of the patient's normal pressure; unless we succeed in stabilizing it at that desired level for some time before in-

ducing anesthesia, the patient's chances for survival are slim indeed. In elective operations blood volume and nutritional status can be restored simultaneously by supplemental feedings with proteins, minerals, vitamins and the judicious use of iron. This is a cheaper and safer method than blood transfusions, but not always applicable.

Next in importance are adequate protein and electrolyte levels in the plasma. It is generally agreed that protein depletion will interfere with wound healing and delay convalescence. Plasma transfusions, especially in burned patients with dehydration and hemoconcentration, will do much to improve the general condition. Storage of the plasma at "room temperature" has reduced the danger of viral hepatitis.

Many of our old patients have an impaired cardiovascular system, and large fluid volumes or rapidly administered infusions might quickly overload the right heart and precipitate pulmonary edema. After the circulating blood volume has been restored to normal by transfusions of whole blood, a marked anemia might remain and require treatment. Packed red cell transfusions might be nearly ideal to restore the hemoglobin to a safe level.

One of the reasons (at least in the opinion of most observers) why there has been such an improvement in the mortality rate after operations for intestinal obstruction is the preoperative management with relief of the distention by nasogastric or intestinal suction and I.V. replacement of fluids and electrolytes lost. In few areas of surgery has the improvement been so impressive for the adequately prepared patient, while there remains a distressingly high morbidity and mortality for those who are rushed to surgery without adequate preparation.

A good guide for the adequacy of the replacement therapy is the urinary output.[69]

The disturbance of the electrolyte balance, especially hyperkalemia is, next to hypoxia, the most frequent cause of cardiac arrest. It may be helpful to give you normal ranges for the most important plasma constituents:
If possible, the electrolyte values should be kept within or restored to these limits.

	mg/100 cc	mEq/L
Sodium (Na)	310-340	135-147
Potassium (K)	16-22	4.1-5.7
Chloride (Cl)	350-375	98-106

Next, comes the correction of cardiovascular disturbances. The mortality of patients with a history of an old myocardial infarct, who are free of precordial pain and dyspnea at the time of surgery, differs not too much from the average for the same age group. The same applies to patients with a history of congestive failure, who are presently compensated. The risk in patients with a recent myocardial infarction, or in acute congestive failure with dyspnea, chest pain at rest or after minor exertion and dependent edema, on the other hand, is so high that only the most urgent life saving intervention seems justified and it should be limited to the minimum necessary to achieve this purpose. Definitive surgery can be attempted with a much greater chance of survival after compensation of the cardiovascular system has been restored. Adequate digitalization can be effected intravenously with strophanthin or ouabaine or Cedilanid with little delay even in emergency surgery. Hypertension or hypotension

as such do not interfere seriously with vital functions if the patient has lived with them for a long time. It is the blood pressure changes that have developed recently or suddenly before or during operation that cause grave concern.[27] More about the treatment later on.

In turning to the respiratory system, we realize that the emphysema of old age is an irreversible end point of a degenerative process. Little can be done to correct this condition as such. It is the accompanying bronchitis with excessive secretions that can be improved at least temporarily with postural drainage, intermittent positive pressure breathing and aerosol treatment with bronchodilators, detergents and antibiotics.

Next, the central nervous system. It may not be possible to achieve optimal status of this system in badly confused patients with senile degeneration. Remember, however, that not infrequently confusion and excitement clear up completely with adequate oxygenation, emptying of an over-distended bladder and judicious supportive treatment. It is always worth a try and much to be preferred to the all too frequent depression of vital functions by excessive premedication. Reassurance of apprehensive patients forms an essential part of our duties; fortunately for us and the patient, serenity prevails in most old people, and we have far fewer problems of excessive fear than in the younger age group. A good night's sleep in those old people may do much towards maintaining their peace of mind.

This brings us to the problems of premedication. Its purpose is sedation without depression of vital functions. In addition, it should reduce reflex irritability and dry up bronchial secretions. As a general rule, the doses in old age should be reduced to about one-half of the usual adult dose, and, if the patients are maintained on tranquilizing or hypotensive drugs, this dose should be further reduced, as already pointed out. Nothing is more objectionable in aged patients than "routine" medication, be it 100 mg. of Demerol or Morphine grs. ¼. Very often the circulation in these patients is depressed, absorption from the intestinal canal or from subcutaneous depots is very slow, and the onset of drug effects is delayed well into the anesthesia causing sudden and unexplained respiratory depression and blood pressure drops. We much prefer to have these patients arrive in the Operating Room without any premedication and give the drugs into the intravenous tubing. We dilute 50 or 75 mg. of Demerol to 10 cc. volume and inject very slowly until the patient indicates the onset of the drug effect, be it a strange taste, some dizziness or lightheadedness, or until you notice constriction of the pupils. We may inject 25 mg. in one patient, the full dose in another, and obtain adequate and controlled sedation. We usually do not reduce the amount of atropine we give with the Demerol; old people seem to be quite tolerant to this drug. We avoid scopolamine in old people; the occasional confusion and excitement it seems to produce far outweighs any advantages to be gained from the retrograde amnesia and sedation it might produce, although we use this drug quite freely in younger adults. We have used phenothiazines in younger people and

have yet to be convinced that they reduce the dosage of anesthetic drugs as advertised. We like them because they seem to make excitable persons less apprehensive and tense. We see no need for this in old people where avoiding depression is our main goal. In comatose or severely depressed patients the only medication given is intravenous atropine.

Anesthesia

It may be superfluous to state that good anesthesia is important at all levels of age, but that it is particularly important at the extremes of old age and infancy, because the margins of safety are so extremely narrow.[47] Rovenstine has stated that the choice of anesthesia should be determined by the physiological disturbance in the patient, the requirements of the surgeon and the ability or the limitations of the anesthetist.[50] Drugs and methods which interfere least with the physiological equilibrium (homeostasis) and the vital functions are preferred, if and when their skillful use can be assured. A well trained anesthetist is able to adjust himself to the needs of the patient and the surgeon in that order. Unfortunately, many of us are familiar only with a few methods and drugs. If this is the case when you are faced with a poor risk patient, as so many of our older people are, then limit yourselves to drugs and methods with which you are thoroughly familiar. Constant vigilance, uninterrupted monitoring of the vital signs and immediate correction of any abnormality as it develops are at least as important (or even more important) than the choice of drugs and methods, provided the drugs are properly used. In the old, as in the very young, the time in which to restore adequate oxygenation and blood flow is very limited, and changes will quickly become irreversible.

I apologize for repeating the obvious need for good anesthesia over and over again; unfortunately, every single one of us tends to relax when all goes well. Many of our difficulties do not occur in major operations when we are alert, but during or after minor procedures, when our guards are down. In old people there is no room for error or a casual approach on our part!

But back to the problem of selecting anesthesia. Whenever circumstances permit, local and regional methods are preferred.[31] We quite agree, even though we remember the many instances where we were called in halfway through the operation, because the block began to wear off or never had been adequate in the first place. Unless you work with somebody who is experienced and proficient in regional methods, you are wise to be prepared for supplementary general anesthesia. I would like to make a few remarks about the use of hypnosis in surgery. About 1920 I was privileged to deliver a large number of women under hypnosis. I, at that time, was the house officer, who delivered the patient, repaired episiotomies, used low forceps, and I was most impressed with the ability of the M.D. who produced the hypnotic trance without fail. But I feel that it is not a method every one of us could master successfully. Furthermore, a certain degree of mental alertness on the part of the patient is necessary, and such alertness we do

not always encounter in old people. I will, therefore, say that at present hypnosis should rather be reserved for the younger age groups.

I will not spend too much time on a discussion of the whole field of regional blocks. But I would like to say a few words about spinal anesthesia, which has recently, especially in California, fallen into undeserved disrepute. I feel that a properly administered and supervised subarachnoid block with a low level of anesthesia is a most desirable method in geriatric patients. But note the emphasis on properly administered and supervised. It is so deceptively simple to puncture the dura that the occasional anesthetist may overlook the need for meticulous aseptic technique in preparing tray and patient. To leave any patient after administration of a subarachnoid block without uninterrupted supervision, with frequent checks on the intercostal activity, recheck of the sensory level and pulse and blood pressure readings, is an invitation to trouble. I realize that our patients here in California are most peculiarly conditioned. Death from a preventable airway obstruction is accepted as an act of God; a post-spinal headache is unforgivable. We, at this point, will do no more than recommend spinal anesthesia. Only rarely will we try to reason with a patient who objects to this method. Fortunately, old people with their calmer outlook on things do not as frequently object and are willing to listen to our advice. And in the average patient in the younger age group it usually does not matter as much anyway whether we give general or local anesthesia.

Local hypothermia or refrigeration may be properly discussed under the heading of local anesthesia. If you plan to use it, allow yourself ample time; if a tourniquet is necessary, apply 3 ice bags to its selected site 45 minutes before you put it on. If you have an electric unit like the Thermorite, fine—but you can do a good job with cracked ice, although it is more cumbersome and rather messy. We schedule our patients for the late morning, have them in the recovery room by 7:30 a.m. to place the ice-bags. Several lengths of bandages are placed under the extremity, followed by two woolen blankets and two heavy rubber sheets. The tourniquet is applied next and the extremity covered with ice. It is most important that the ice be finely shaved; large chunks of ice will leave air pockets next to the skin and cause spotty anesthesia. With fine shavings you can be sure that the skin will be completely covered. We use between 100 and 150 pounds of ice for a mid-thigh amputation. The rubber sheets and the blankets are folded over the ice and secured with the bandages. The woolen blankets on the outside will provide adequate insulation and quickly slow down the melting, that is at first quite rapid. Elevate the head end of the bed to provide drainage into a pail at the foot end and replenish the ice as may be needed. We allow about 3 hours (more for very heavy, fat legs) for adequate anesthesia, and the patient will not be put on the operating table until instruments and surgeons are ready. With this method the surgeon has to wait for us gloved and gowned, so that he can proceed immediately. Instruments and solutions should be cold. Keep in mind that you have

about 20 minutes of adequate anesthesia left after the tourniquet has been removed at the end of the operation. In patients with obliterative vascular disease a tourniquet may not be required to prevent chilling of the body from the returning blood, and adequate anesthesia can then be obtained and maintained without the tourniquet. After the amputation is completed, 3 ice bags are put on the stump and every 8 hours one of them is removed. Crossman and Allen recommended this more than 20 years ago, and we still feel that it is a good way to cut down postoperative pain by gradual rewarming.

This brings us to general anesthesia, and I would like to make a few comments on the use of general hypothermia. Our experience in the older age group is limited to a few patients, all of them for extensive aortic homo- and heterografts, and all of them chilled by immersion in ice water. This method reduces tissue metabolism and thereby increases the tolerance of local hypoxia during the clamping off of the large arteries. We have no experience with profound degrees of hypothermia below 28°-30° Centigrade, nor with prolonged hypothermia in combination with a pump oxygenator and cardiopulmonary bypass. We doubt that surgery of such magnitude as to require bypass will become popular in geriatric patients; moderate degrees of hypothermia for vascular surgery or extensive resection for malignancy will protect the patient and has been useful in the "younger" old patients. All our patients were below 65 years of age.

In this area general anesthesia means use of an ultra-short acting barbiturate alone or in combination with a muscle relaxing drug. Outside of teaching institutions, inhalation anesthesia has become the exception rather than the rule. However, I shall begin my discussion with inhalation anesthesia and analgesia. The factor that limits the use of gases or volatile drugs in older people is pulmonary emphysema more than any other preexisting complication. Unless the pulmonary ventilation is manually assisted or maintained with any of the numerous ventilators, we have to anticipate a delayed induction period as well as prolonged emergence, with all the complications which such prolongation might entail. Emphysema interferes with ventilation, the mechanical movement of respiratory gases in and out of the alveolar space, much earlier than with the respiration proper, i.e. the diffusion of oxygen and carbon dioxide across the alveolar membrane. Only in the presence of severe pulmonary fibrosis, as in the end stages of the different pneumonoconioses and Beryllium disease, will mechanical ventilation be inadequate to insure proper oxygenation; in the ventilatory insufficiency of uncomplicated emphysema adequate manual ventilation should prove most helpful, especially with moderate degrees of positive pressure. We have used intermittent positive as well as positive-negative pressure devices and have been satisfied with both types, as long as we avoided excessive positive pressures, that might seriously interfere with the venous return to the heart. We appreciate the freedom to attend to other things that these mechanical devices give us—like another pair of hands—but we miss the "feel of the bag", that gives us an unsurpassed index of depth of ventilation and an-

esthesia, muscular relaxation and pulmonary compliance. The continuous metering of the gas volumes exchanged is helpful with a ventilator and has indicated bronchospasm or a leak in a closed system which we might not have discovered quite as early, but probably not any earlier had we practised manual ventilation. I will not enter in the controversy of ventilators with fixed volume versus the fixed pressure device. I feel that a pressure controlled apparatus avoids dangerously high intratracheal pressures which might, in the presence of emphysema, lead to rupture of alveoli and interstitial emphysema and pneumothorax. On the other hand, unless you measure the actually delivered air-or gas volumes, your ventilator might blow off its mixtures into the room, especially with reduced pulmonary compliance as in asthma and fibrosis.

After these general remarks, let us review the available gases and volatile drugs. Nitrous oxide is a safe and non-explosive gas, provided it is given not just with enough (20%), but with ample (50%) oxygen. Of course, it is the least powerful drug available, it does not provide muscular relaxation, nor does it obtund the more painful stimuli and the reflexes set up by them. Ethylene has been used extensively in some centers. Its low toxicity and potency are unfortunately compromised by its high flammability. Our surgeons generally use the electro-surgical unit for major and minor procedures and make the use of ethylene (or any other flammable agent) rather hazardous. The increased potency of other gases and volatile drugs is usually accompanied by increased toxicity and very often by high flammability. I have only limited or no experience with some of the newer halogenated hydrocarbons like Trichlorethylene or trifluorobromo-chlorethane (Fluothane), but I have had rather ample experience with chloroform. From the literature available I would compare the pharmacological effects of these drugs to chloroform: rapid, pleasant induction, with profound effects upon the myocardium and the cardiac conduction system. For the latter reasons alone I would hesitate to employ these drugs in old people at this time even though they seem to be useful for younger patients.

Cyclopropane has a very definite place in our armamentarium; its limitations are its flammability and its possible effects on the cardiac conduction system and the so-called "emergence delirium" and cyclopropane shock. Recent research seems to indict CO_2 accumulation and sudden shifts in the CO_2 level, as the cause for these complications that had been thought inherent to the drug. With proper ventilation, either manual or by a mechanical device, we probably can avoid arrhythmias, blood pressure drops and delirium. We feel that cyclopropane is the drug of choice in the severely toxic patient with liver damage or metabolic acidosis. Arteriosclerotic heart disease *without* disturbed rhythm does not contraindicate cyclopropane, but still we would hesitate to use this drug in the presence of cardiac arrhythmias. We would use it more frequently in old patients if our surgeons could work without the Bovie unit.

Ether provides good relaxation with adequate oxygenation at safe levels of anesthesia. Its drawbacks: flammability, a tendency to produce aci-

dosis and possible damage to liver and myocardium at deep levels. It is undesirable in diabetic or jaundiced patients. However, even 15 years ago I would have recommended ether and cyclopropane as the most desirable agents for general anesthesia.

And at that time I would have had only a few good words for the ultra-short acting barbiturates like Pentothal with their cumulative depressant effects, when given over a long period, their delayed detoxification in the aged and the vagal effects with laryngospasm and bronchospasm. We would have talked at great length about the fatal effects of the drug in deep abscesses of the neck with carotid body involvement.

These limitations still exist, but the advent of muscle relaxing drugs has changed our attitude considerably. Ultra-short acting barbiturates undoubtedly produce the most rapid and pleasant induction ever experienced by our patients. If you take care to inject the drugs slowly and in small increments and let yourself be guided by the patient's response, sleep will be obtained without undue depression. Light analgesia with N_2O-O_2 50% or more and muscle relaxants will permit you to have the patient awake at the termination of surgery. Or you may supplement or replace N_2O with small fractional doses of a narcotic, be it meperidine (Demerol) or alphaprodine (Nisentil) alone or combined with one of their antidotes, like nor-allyl-morphine (Nalline) or levallorphan (Lorfan). Theoretically, it is an excellent idea to combine morphine and its substitutes with an antagonist that will give full analgesia while abolishing the depressing effects on respiration and blood pressure. But you should keep in mind that most of these "antagonists" are really competitive with depressing effects of their own when given alone, and that they may wear off at a rate very different from that of the drug they are supposed to neutralize, leaving you again with a depressed patient. This, incidentally applies to barbiturate antagonists like glutarimide (Megimide) and probably methylphenydate (Ritalin). To sum it up, these antagonists still require your undivided attention and supervision. Whichever drug you prefer in old people, you try to produce a light sleep (not anesthesia) with a fast barbiturate, give pain relief with a narcotic or analgesic and provide muscle relaxation and possibly block reflexes with a member of the curare group; keep your dosages to a minimum given at low speed. In other words, minimal anesthesia is quite well tolerated by old people, especially if you avoid hypoxia and hypercarbia through adequate ventilation.

As previously mentioned, the need for adequate ventilation in the presence of emphysema and, especially, when muscle relaxing drugs are used, makes endotracheal intubation nearly mandatory. To try to ventilate a toothless old person with receding jaws with either manual pressure or a machine through an ill fitting mask seems a rather hopeless task. I have seen sponges and other objects used in the mouth and around the mask where an easy intubation would have solved the problem and in addition reduced the dead space about 100 cc and allowed for effective tracheobronchial aspiration, which is of particular importance in oldsters. To avoid gastric distention during con-

trolled ventilation by endotracheal intubation alone outweighs the possible complications from intubation.

As to the ultra-short acting barbiturates, I have no marked preference for any particular one. Neither Surital, Neraval, Kemithal or Evipal differ enough in their chemical structure from Pentothal to expect *essential* differences in their effects, regardless of the advertising claims. All produce sleep-like unconsciousness, none obtunds reflex stimulation at safe depths, nor do they provide muscular relaxation. All have some unpleasant side effects, usually due to vagal stimulation, like coughing or sneezing, and all can precipitate laryngo- and bronchospasm.

For a muscle relaxant you want a drug that acts promptly and is quickly destroyed. Succinylcholine theoretically should meet these two requirements ideally. Unfortunately, we occasionally encounter patients who exhibit apnea and muscle paralysis long after the drug has been discontinued. Nearly all of our patients who displayed this complication were severely emaciated from chronic infection or neoplasms or just plain malnutrition, most of them as you might expect, old people. Whether there exists a deficiency of cholinesterase, so that Succinylcholine is not as rapidly destroyed as usual, or whether an imbalance of some electrolytes is responsible, I do not know. Prostigmine and Edrophonium, the curare antidotes, are of course useless with a depolarizing agent and tend to enhance the paralysis—fresh blood with an adequate cholinesterase level should be helpful, but its procurement will take time, and meanwhile you have to maintain your patient on controlled ventilation anyway. All our old people finally resumed breathing on their own, sometimes after several hours. I have not seen this complication with decamethonium (Syncurine) and rather prefer this drug in old people. Certain antibiotics like streptomycin and especially neomycin can produce a paralysis of the striated muscles that cannot be distinguished from curare effects. After reading of several deaths following large intraperitoneal neomycin doses, we try to discourage its use in abdominal emergency surgery.

It is our ambition to have our patients, and especially old patients, awake at the end of the operation. I firmly believe that this aim can be better achieved with minimal amounts of the drugs discussed rather than with the free use of narcotic or barbiturate antagonists at the end of the operation. If you are fortunate enough to have a recovery and intensive care unit available, you may probably turn the patient safely over to such a unit. We return our old people to the recovery room with the endotracheal tube in place; whether we insufflate oxygen by nasal catheter into the tube at flow rates below the normal nasal flow rate of 4-8 liters/min., or whether we continue ventilation with a Bennett or similar IPP unit, depends on the adequacy of the tidal volume. Gentle tracheal suction encourages deep breathing and coughing and we will not extubate until the patient actively objects to the tube. However, if you have to return your patient to his room, do not relinquish his or her control until an adequate tidal volume and a free airway are assured!

Conclusion

We as members of the surgical team, have a special responsibility to old patients. Many of them suffer from advanced degenerative processes in vital systems and organs, but even the ones in good shape have a marked reduction of their ability to withstand stress and to adapt their physiological functions rapidly enough to such stress. It is our task to maintain vital functions, like ventilation, circulation and oxygenation at the best possible level and close to the individual patient's own normal values. We realize the cumulative effects that even small deficits in oxygen supply and blood replacements, electrolyte imbalance, over-generous medication and hydration may have in the presence of impaired homeostasis. Only meticulous attention to the smallest detail and continuous vigilance will give these old people a fair chance of survival.

To provide adequate oxygenation and to maintain all vital functions in an optimal state is as much our responsibility as a relaxed and motionless field of operation. I, for one feel, that the patient's safety takes precedence even over the surgeon's convenience. I hope that I have impressed upon you the tremendous difference in the mortality rates between well prepared patients and the hurried intervention in depleted, toxic and overmedicated old people. Reference: *Tables 2 and 3*. The progress we have made in the last 20 years has been only partially due to startling new discoveries; most of it has been accomplished by the faithful and persistent application of knowledge that has been available for a long period of time.

Death rate in 3,656 operations	2.95%
Under 60 years in 2,557 operations	2.07%
Over 60 years in 1,099 operations	5.01%
Death rate over 60 years in emergencies (about 3 times the rate in elective procedures)	17%

(Cole)
Table #2

1942 - 1953: 46,253 Operations
5,450 operations in 5,075 patients 60 years and older (11.8% of patients)

71.4% male	2/3 60-70 years
28.6% female	1/3 over 70 years

26.8%	Status I (no complications)
48.1%	Status II
19.6%	Status III
1.0%	Status IV
12.4%	Status V
3.8%	Status VI
0.7%	Status VII

(Corssen)
Table #3

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(Continued on Page 139)

The Role of the Nurse Anesthetist in Cardiac Surgery

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Introduction

There are many and various types of surgical procedures being done successfully today for the correction of cardiac and vascular anomalies. This has resulted from intensive research in the surgical as well as anesthesia techniques. Many articles have been written and published on the various techniques of management of anesthesia in conjunction with experiments; but, this discussion pertains to the detailed management of anesthesia from the position of the nurse anesthetist for cardiac surgery employing the cardio-pulmonic by-pass technique with the pump-oxygenator.

Anesthesia

The management of anesthesia for the patients undergoing intracardiac surgery by means of a pump-oxygenator differs in no important respect from the anesthetic management of patients for cardiovascular procedures.

The basic principles of a properly administered general anesthesia are utilized for patients with cardiovascular abnormalities. These include adequate oxygenation of all tissues, the preservation of adequate cardiac action, and decreasing the irritability of the heart. All factors such as nausea, vomiting, hypotension, hypertension, carbon dioxide excess, or hypoxia must be meticulously avoided. The most serious anesthetic complications encountered during anesthesia for heart surgery are oxygen want, hypotension, cardiac arrhythmias, carbon dioxide retention, anesthetic overdosage, and cardiac asystole.[3]

Oxygen deficiencies are best managed by prevention. To secure this end result, a higher arterial oxygen tension is present during induction and intubation by giving the patient oxygen by mask.

The demands of surgery often contribute as much to the problem of ventilation during anesthesia as the anesthesia itself. Foremost among these demands are those encountered during thoracotomy. For in this procedure, the respiratory mechanism suffers a derangement which could prove fatal, if it were not for the supportive measures of the anesthetist. Pulmonary collapse, mediastinal shift and reflex activity, all contribute to progressive hypoxia and carbon dioxide retention on a scale which has only recently become recognized and ap-

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preciated. The fundamental basis of anesthesia and resuscitation is still the maintenance of an intact and adequate circulatory and respiratory system. Any degree of deviation from adequacy will multiply the anesthetist's job of maintaining vital function, and none is more immediately vital than an exchange of respiratory gases of concentrations approaching normal, or better than normal levels.[2]

To adequately take over a patient's respirations, one or more conditions must be present, and these are usually contingent on a state of depressed activity.[2]

Patients who undergo these operations are not digitalized preoperatively unless they have manifestations of cardiac failure. They are not digitalized during the operation before extracorporeal perfusion, because unknown quantities of the drug may be lost in the process. Indications for digitalis following perfusion include supra-ventricular tachycardia or unequivocal evidence of myocardial failure—pulmonary edema. Ventricular tachycardia or fibrillation has been observed during perfusion at the cessation of asystole, but invariably reversion to a normal rhythm has followed electrical defibrillation. An essential feature of successful defibrillation is adequate total perfusion at the time.[1]

An anesthetist should be able to detect conduction abnormalities of cardiac arrhythmias by careful palpation of a peripheral artery and by direct vision of the heart. She should watch the operative field closely so that she is aware of causes producing any changes in the patient's condition.

Alterations in hemodynamics occur with any surgical maneuver which interferes with flow of blood into, or out of the heart. Such incidents occur with displacement of the heart from the pericardial bed with obstruction of an orifice in intracardiac exploration with a finger, and with cannulation or dissection and torsion of the vena cavae. If any such action seriously interferes with cardiac output, it is called to the attention of the surgeon. Cessation of manipulation restores normal dynamics. Occasionally the insertion of cannulae in the caval veins interferes with venous return or obstructs cerebral vascular flow sufficiently to cause transient alterations in the electroencephalogram. These rather often are observed with small children.[1]

Equipment

The anesthesia supplies and equipment are prepared and checked the night preceding the morning of surgery. These consist of a gas machine, preferably Heidbrink or Forreger equipped with cyclopropane, and insufflation ether attachment if the patient is a small child. In addition the usual intratracheal set with a laryngoscope, two per cent lidocaine atomizer, plastic oro-pharyngeal airway, three sizes of intratracheal catheters (cuffed, if a size larger than number six required), and metal guides are prepared. Connectors of appropriate sizes to attach the intratracheal tube to the breathing tubes or cannister, whistle tip suction catheters with fingertip control and mouth suction tip are among the items available. Also prepared are a stethoscope, blood pressure set, extra luer syringes and needles, a portable suction machine and rectal telethermometer. A water mattress and irrigating flasks for controlling body temperature are available.

Preanesthetic Medication

Doctor Adriani has listed five reasons for ordering preanesthetic medication: (1) psychic sedation, (2) reduction of metabolic rate, (3) to obtain an additive effect between a non-potent drug and one which is more potent, (4) abolition of secretions from the respiratory tract, and (5) prophylaxis to avoid anticipated undesirable effects.

Atropine sulfate was used interchangeably with scopolamine as the belladonna drug for the fifty cases which are included in this series. Sedation was induced by the use of morphine sulfate on most of the patients while barbiturates (as Nembutal® and phenobarbital) and Demerol® (meperidine) were used for others.

Induction and Management

Before the induction of the anesthesia, the operating room is fully prepared with sterile instrument table set up, and the suture nurse is scrubbed. The defibrillator is maintained in the operating room and in good working order at all times. The surgeon is present and gives the permission to go ahead, following word from the blood bank that the necessary amount of blood for the pump and patient is drawn and crossmatched with that of the recipient. Blood is drawn the morning of the operation. That which is to be given directly to the patient to replace blood loss is citrated and used before heparin and after protamine sulfate have been given. That which is to be used in the pump-oxygenator is heparinized.

The induction of the patient is done in the anesthetic room where it is quiet and he is not disturbed by conversation or sights accompanying the operating room. Patients from the pediatrics department or nursery are brought to the surgical floor in their beds or cribs, and patients older than fourteen years of age are brought on stretchers by orderlies. The preoperative medication is given thirty to forty-five minutes prior to patients coming to surgery so that it has had a chance to produce the desired effect. Some children are quite apprehensive on arrival but this is usually relieved after talking with them and explaining what we expect to do. The patient is placed on the operating table which has been prepared with the water mattress. A blood pressure cuff and stethoscope are applied and initial blood pressure, pulse and respiratory rate recorded. The anesthetist always has another anesthetist assisting her to keep a complete and meaningful record, and handle extra duties entailed with this type of technical procedure. If the patient doesn't object to the face mask, and we do not wish to use a thiamylal induction, we prefer to use cyclopropane for the induction agent. Some older children will allow us to do a venipuncture for induction with thiamylal which is a little faster method and more pleasant for the patient. With this technique it is necessary to use an adequate dose of short-acting muscle relaxant for intubation, such as succinylcholine chloride. This is accompanied by adequate ventilation with oxygen. After intubation the breath sounds are checked bilaterally and pulse and blood pressure noted and recorded. The rate and quality of the pulse are watched closely at all times. For children with small vital capacity who cannot be maintained with the circle absorber and short tubes, we use the to-and-fro soda lime canister technique, semi-closed with

high flow of nitrous oxide and oxygen and a sufficient amount of cyclopropane to produce light level anesthesia. The tail end of the breathing bag is left partially open for exhaust of excess gases. For anesthesia maintenance in adults we use cyclopropane and oxygen with closed technique, or with nitrous oxide using the semi-closed technique with manually controlled respirations from the time of intubation until the chest wall is closed tightly.

As soon as the patient is asleep, the surgeon performs an intravenous cut-down in the right saphenous vein at the ankle with a number sixteen cannula to insure a reliable transfusion route during surgery. This site is selected as being more accessible to the circulating nurse and less in the way of the surgical team. The left femoral artery is used for the perfusion. After the cut-down is finished and an infusion of five per cent dextrose in .2% saline is started slowly, the rectal thermometer is inserted, and the patient is moved to the operating room. The patient is left in the supine position which allows for the transverse sub-mammary incision of the anterior chest wall which opens both pleural cavities with sternum resected. The sites of the two femoral arteries are exposed for cannulation. The leads for encephalogram and electrocardiogram recordings are inserted, and extremities restrained.

The temperature of the patient is noted and recorded frequently. If it rises above 100° F., cool or ice water is circulated through the mattress to reduce the temperature to within normal limits. If it falls below 98 degrees, warm water, 125° F. is used to increase body temperature. A reduction of body temperature during perfusion results from the loss of calories from the blood as it is circulated through the machine, which is at room temperature; although, the blood which is 90 degrees or more has been kept in water at 101 degrees.

Blood is administered intravenously by slow drip as soon as the incision is made. Hemodynamic alterations due to loss of blood can be minimized if the amount lost is accurately ascertained and replaced. Meticulous attention therefore is given to the maintenance of a record of blood lost and replaced. The gross estimate of loss of blood is derived by adding figures for the following items:

1. Weighed loss: gain in weight of sponges and packs received from the operating table during the procedure is accurately ascertained by the circulating nurse and recorded.

2. Measured loss: the volume of blood and saline solution removed from the patient by the surgeon's suction tip to a calibrated suction bottle during operation.

3. Visual and miscellaneous: the volume of blood lost from the patient on the drapes surrounding the wound is estimated by the surgeon.

The net amount of blood lost is computed by subtracting from the figure for gross loss the volume of saline used. The total or net volume of blood replaced is the actual amount of whole blood given to the patient via transfusion plus any that may have been given from the pump.

Added information on blood volume throughout the operation is provided by the arterial and venous pressures. A persistently low level or progressive decrease in both pressures suggests that blood volume has de-

creased. During the period of actual perfusion the values for arterial and venous pressure, rate of blood flow, and oxygen saturation of venous blood provide useful information on the blood volume of the patient. The volume of blood replaced never exceeds the measured loss. In the event that hypotension exists when there is otherwise every indication of normal blood volume, we prefer to support the arterial blood pressure at a systolic level of 75 mm. of mercury or higher with an intravenous infusion of Neosynephrine® or Aramine® via the pump. The estimated blood loss and replacement volume is made at certain stages of the procedure and whenever there is question as to the blood loss and replacement. The tally is made before by-pass is begun, before it is stopped, after it is stopped, and after the thorax is closed. This final appraisal is written on the anesthesia record for the benefit of the surgeons and the nurses in the recovery room.

Before the atrium is clamped and the heart is explored digitally, heparin is injected intracardially or given intravenously to prevent clotting of the blood. After the superior and inferior venae cavae have been cannulated through the atrium, and the left femoral artery has been cannulated for the by-pass, and all are connected to the pump-oxygenator, an intravenous injection of tubocurarine is given to control the patient during the perfusion. An interval of five minutes is allowed to elapse before the pump is started. The dosage of tubocurarine is computed on the patient's weight at the rate of one milligram per five pounds body weight, although sometimes this amount is not sufficient to obtain an absolutely quiet surgical field. In those instances the tubocurarine has been repeated through the arterial side of the pump. While the defect is being repaired, the patient is not ventilated except for slight movement of the breathing bag to prevent stasis of air in posterior alveolae. The color of the patient is watched and pupils are checked as to dilatation and reaction to light. The heart continues to beat during most of the procedures but occasionally when one desires to produce cardiac arrest, a solution of potassium citrate and magnesium sulphate is injected into the aorta, the solution perfuses into the coronary vessels and cardiac arrest occurs. If the beat does not return of itself, calcium chloride is injected as an antagonist. In the event of ventricular fibrillation, the defibrillator and perhaps massage are necessary to restore the heart to its normal rhythm. When the venae cavae clamps are off, a state of parallel circulation exists and again the anesthetist ventilates the patient vigorously until the pump is discontinued. The blood pressure and pulse are readily obtained on most patients following resumption of circulation but some have been noted to develop peripheral vasoconstriction, making it difficult to ascertain them.

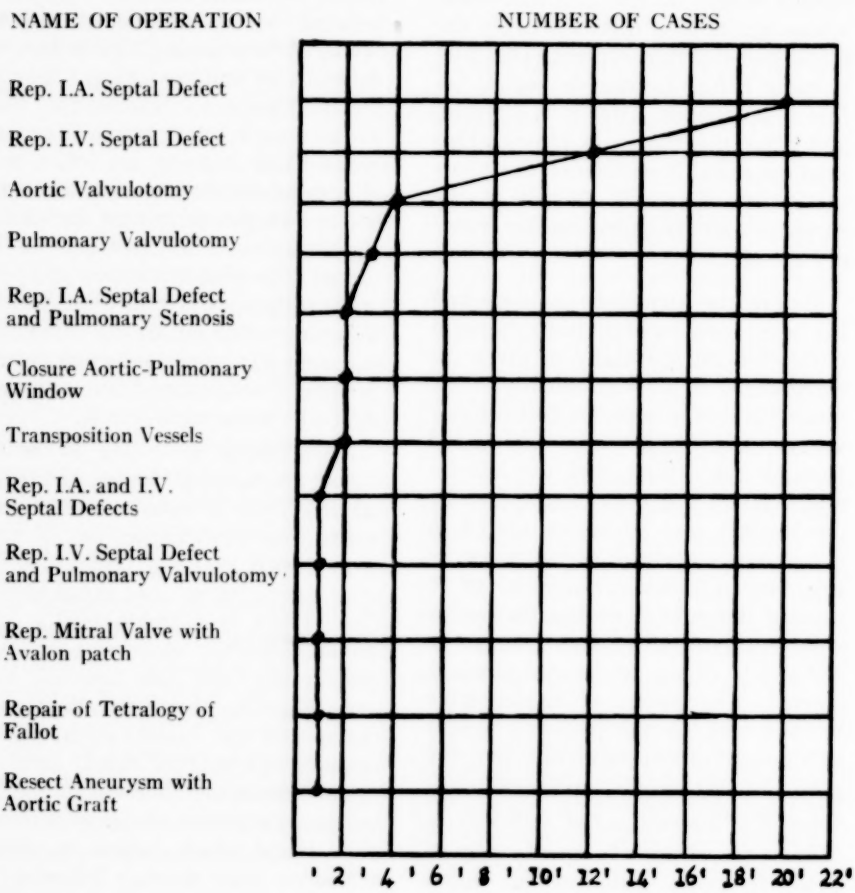
Arrhythmias are prone to develop during the surgical closure of the septal defect due to suturing of the atrial walls. The irregularities are of atrial origin, such as atrial premature systoles, atrial flutter, and atrial fibrillation. There is a characteristic syndrome following superior vena caval obstruction, and the superior vena cava may be obstructed during the closure of an atrial septal defect, causing cyanosis of head, face and upper extremities followed by marked venous distension of upper extremities. Heart block, which is usually transient, may develop following su-

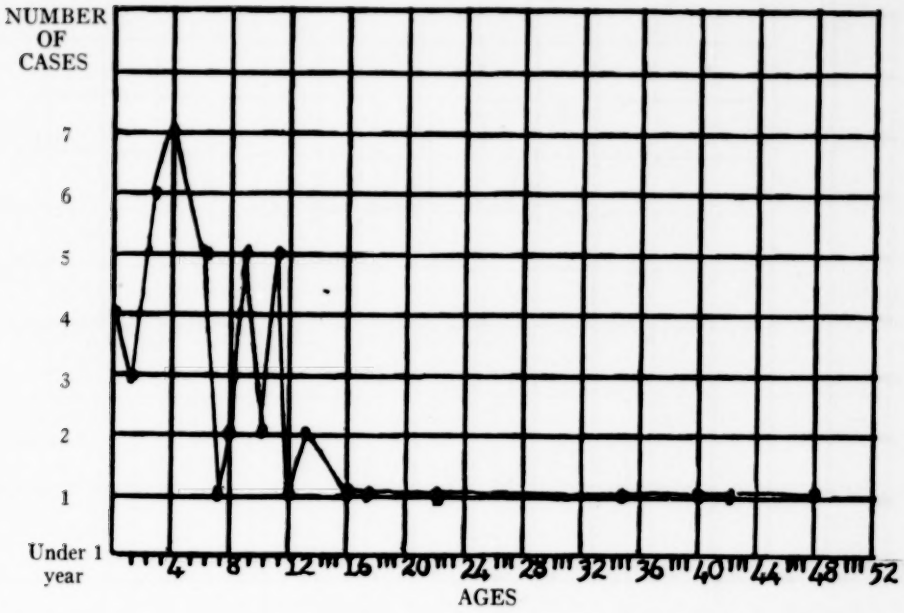
turing an intra-ventricular septal defect.

Five to ten minutes after the perfusion is completed and the venous and arterial cannulas have been removed, protamine sulfate is given intravenously to neutralize the effect of the heparin. The patient is not suctioned after haparinization lest the mucous membrane of the oral cavity or trachea be traumatized and bleeding occur which could not be controlled. If suctioning is necessary, we wait at least thirty minutes after the protamine has been given.

Most of the patients require additional amounts of anesthetic following the perfusion but others do not manifest signs of reaction until near the end of the procedure. We feel that it is important to have the patients awake and responding following extubation. We accompany the patient, who is in his bed receiving oxygen, to the recovery room where he is placed in an oxygen tent. A special duty nurse is ready to give her undivided attention to the bedside care of the patient.

During the period beginning July, 1957 and ending July, 1958, anesthesia for fifty pump cases was adminis-


NAME OF OPERATION
NUMBER OF CASES
Rep. I.A. Septal Defect
Rep. I.V. Septal Defect
Aortic Valvulotomy
Pulmonary Valvulotomy
Rep. I.A. Septal Defect and Pulmonary Stenosis
Closure Aortic-Pulmonary Window
Transposition Vessels
Rep. I.A. and I.V. Septal Defects
Rep. I.V. Septal Defect and Pulmonary Valvulotomy
Rep. Mitral Valve with Avalon patch
Repair of Tetralogy of Fallot
Resect Aneurysm with Aortic Graft
' 2 ' 4 ' 6 ' 8 ' 10' 12' 14' 16' 18' 20' 22'



tered by the nurse anesthetists currently on the anesthesia staff of the University of Michigan Hospital at that time.

Of the total number of cases observed in the series, nineteen were females and thirty-one were males. The ages ranged from eight weeks of age to forty-eight years of age, and weights ranged from 7 pounds 9½ ounces to 177 pounds.

The amount of blood lost during surgery varied from 230 cc. to 2500 cc., depending on the size of patient, type of operation and length of time the pump was on.

Cardiac arrest was induced in five of the patients with potassium citrate and magnesium sulfate solution and all recovered satisfactorily after the drug was detoxified. One patient developed ventricular fibrillation and another had cardiac arrest. Three of the patients expired a few hours following surgery but they were very poor risks. One patient during closure of defect developed a heart block which was transient.

The accompanying graphs serve to illustrate some data collected from the anesthesia records:

1. Graph showing names of operation and number of patients in each category.

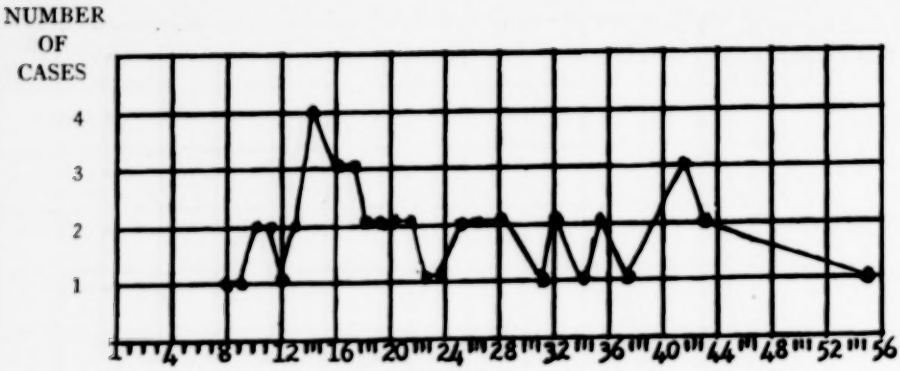
2. Graph showing age of patients and number of operations performed in each age group.

3. Graph showing number of cases and length of time the pump was on during procedure.

4. Graph listing various techniques used and agents employed in each.

Tubocurarine was used in 45 cases while the pump was on, and anileridine (Leritine) was used on one.

Thiamylal 2% was used for induction on thirteen cases.



Techniques	C_3H_6 + O_2	C_3H_6 + E.V.+O_2	C_3H_6 N_2O E.V.+O_2	N_2O Ether O_2	C_3H_6 + N_2O+O_2	N_2O Demerol O_2
Closed Circle	11	2				
Semi-closed Circle			5	2		2
Closed To & Fro	1					
Semi-closed To & Fro		5			10	
N R B	1		7	2	2	

AGENTS

Summary

Patients with cardiac disease tolerate heavy preliminary medication and deep anesthesia very poorly.

Oxygen is the one gas that must be adequately administered to preserve cardiac action and life. Endotracheal catheters are essential to maintain a patent airway during anesthesia for cardiac surgery because it is necessary to control respirations.

The most important person is the patient, and every member of the team, surgeon, anesthetist and nursing personnel, must never lose sight of this concept. It is imperative that the anesthetist has had sufficient experience in thoracic surgery anesthesia before accepting the responsibility involved with open heart surgery.

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Spinal Anesthesia: Postanesthetic Complications

Part II

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Neurological Complications

Some of the most dreaded complications of spinal anesthesia are the neurological complications. Fortunately these are rare, but they are distressing and disabling when they occur. Neurologic complications occurring after spinal anesthesia are: (1) Headache, (2) cranial and other nerve palsies, (3) paraplegia and other afflictions of the cord due to myelitis, trauma and other factors, (4) infections of the cord and its coverings due to bacterial contamination, and (5) sterile inflammation of the meninges due to drugs.

Headache

Headache following lumbar puncture is distressing and annoying, but is neither dangerous to life nor permanent. Much has been written about its etiology. It is well established that it is caused by the loss of cerebrospinal fluid from the perforation of the dura by the needle. The use of small gauge needles is advocated to reduce the incidence of headache. These headaches are characterized by a reduced spinal fluid pressure. Headaches may also be reflex in origin due to meningeal irritation (meningismus) from chemical irritation by the drug. These are often associated with an increased spinal fluid pressure. The incidence of headache is apparently higher in obstetric patients because the alternate increase and decrease of intra-abdominal pressure is transmitted to the peridural veins via the abdominal veins. The spinal fluid pressure around the cord is increased with each uterine contraction by this "milking" action around the arachnoid. The fluid is then forced out of the perforation.

Post-lumbar puncture headache is easily diagnosed. Usually it appears the first day after the spinal anesthetic was given. It is throbbing in character, and is distributed behind the orbits, the frontal area or in the occipital region. Occasionally it is felt in the back of the neck. Nausea may be present. It is aggravated by a change in position, particularly

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when the patient sits up after reclining. The type due to meningeal irritation is ordinarily confined to posterior aspect of the neck and is aggravated by flexing the head, back or even the legs. No fever is associated with post-spinal headache. Ordinarily a headache lasts three or four days and then gradually recedes. In more persistent cases, it may last ten days or more. Obstinate cases have been known to last for months; however, this is uncommon.

The numerous therapeutic procedures which have been suggested for relief of headaches are directed towards restoring the hydrodynamics of the cerebral spinal fluid to normal. Hypotonic solutions are administered to promote the secretion of cerebral spinal fluid. Drugs which decrease urinary output, such as pituitary extract, or drugs which cause retention of fluid, such as the adrenal hormones (Cortisone) have been advocated. Direct replacement of the fluid in the subarachnoid space by injection of normal saline promptly relieves the headache for periods of several hours, several days or even permanently. The injection must be repeated a number of times before complete relief is obtained. The peridural injection of saline has been tried also and has met with some success. The intracaudal injection of 25 to 30 cc. of saline is as effective as the peridural injection. Usually one or two injections at 12 to 24 hour intervals will suffice. Vasodilating drugs have been administered to increase the blood flow through the choroid plexus, thereby increasing the formation of cerebrospinal fluid. Nicotinic acid, intravenous alcohol and the nitrates are drugs with such an action but none of these has yielded dramatic results. Each has at various times proved partially or completely successful.

Cranial Nerve Involvement

Palsies of the cranial nerves are also associated with loss of cerebrospinal fluid and spinal headache. The nerve most commonly involved is the sixth (abducens). Several days after the spinal anesthetic the patient complains of double vision (diplopia). The cushioning effect at the base of the brain is lost when spinal fluid is lost. The pressure of the brain upon the base of the skull causes the traction of the dura and the vessels and produces the headache. In addition, traction on the cranial nerves results. The sixth nerve is the longest and the slenderest of these and is easily traumatized. The diplopia is transient, lasting several weeks to months.

Direct connections have been demonstrated between the labyrinth and the subarachnoid space. Loss of spinal fluid, therefore, causes disturbances of fluid pressure in the labyrinth which may cause dizziness and possibly deafness.

Cauda Equina Syndrome

The most serious complication of spinal anesthesia is paralysis of the extremities (paraplegia) often called the "cauda equina syndrome." The symptoms are referable to the area supplied by the nerves composing the cauda equina. The onset and symptoms of the syndrome follows no set pattern. In some cases the spinal anesthetic is induced successfully and is uneventful during the operation but the block merely fails to disappear within the usual time. The patient remains paralyzed. In others, the patient complains of excruciating

pain as the drug is injected. Shock and coma follow from which the subject recovers hours later with a fully established paraplegia. In others the patient is returned to bed apparently in good condition. Several hours later shock with coma supervenes, from which the patient recovers with a paraplegia. In others the patient recovers fully from the anesthetic, and days later notices weakness, numbness, and other sensory changes in the extremities. The neurologic changes gradually become worse until paralysis is complete. Foster Kennedy described a chronic arachnoiditis which he assumed to be due to spinal anesthesia. The symptoms were delayed from six months to a year after the spinal anesthetic had been administered. Evidence is beginning to appear that, in these cases, the spinal anesthetic is incidental to a slowly developing arachnoiditis.

Irrespective of the manner in which the syndrome develops, the patient is paralyzed below the waist, develops fecal and urinary incontinence, contractures, atrophies and other manifestations of damage to the cord. In the milder cases the symptoms may recede after a few weeks and the patient recovers both motor and sensory function. In others the symptoms persist or become worse for several weeks and then remain stationary. As a rule, paraplegias which fail to improve after five or six months are permanent. Recovery, if it occurs, is usually complete within five or six months.

Fortunately this complication is rare. In eighteen years' experience at the Charity Hospital, in which approximately 35,000 spinal anesthetics have been administered using procaine, tetracaine and dibucaine, no major neurologic complication has developed. Others who have comparable series report the same experience. Reports of three or four paraplegias in series as small as five or six hundred spinal anesthetics have been made. The workers reporting such a high incidence should critically review their technique and examine the drugs used in order to eliminate the cause of their difficulty.

The etiology of the cauda equina syndrome is not known. The incidence is no higher with the longer lasting, more potent drugs than with the short acting. It occurs no more frequently with tetracaine (Pontocaine) or dibucaine (Nupercaine) than with procaine. Reproduction of the cauda equina syndrome in animals has been successful only when concentrated solutions have been used. Some workers feel that the concentration rather than the total dosage is the most important factor. Data in support of this contention is not adequate. Neurologists feel that pre-existing neurologic disease, such as spinal cord tumor, degenerations of the cord, myelitis, etc. are aggravated. There is no data to support the belief that these drugs aggravate a pre-existing disease of the spinal cord, such as tabes, old poliomyelitis, combined degeneration and so on. Nonetheless, one should avoid spinal anesthesia in these cases. Trauma to the cord by the spinal needle has been incriminated. This may occur when the lumbar puncture is performed above the second lumbar vertebra. In the majority of patients the cord ends between the first and second lumbar vertebrae. In less than 10% of patients, the cord extends below the second lumbar vertebrae. If one confines the area of puncture below

the second lumbar this complication is averted.

The caustic solutions used for cold sterilization of ampules of drugs may pass into the ampule through microscopic cracks. The American Society of Anesthesiologists passed a resolution at their annual meeting in Kansas City in 1956 that spinal anesthetic drugs should be autoclaved and frowned upon the cold sterilization technique. One, thus, is now obligated to follow the custom whether or not he agrees. Detergents and other materials used for cleaning needles have been incriminated as the cause of neurologic changes. Some experimental evidence supports this contention. The wrong drug has been injected and caused injury. Ampules containing mercurial diuretics have been mistaken for the local anesthetic and were inadvertently injected intrathecally with serious consequences. Precipitation of the local anesthetic drug when it comes into contact with the alkaline spinal fluid has been suggested as a possible cause of damage. Allergy is invariably mentioned in discussions of reactions involving drugs. It is possible, but not probable that allergy plays a role in causing the syndrome. The fear of this syndrome, rare as it is, with its possible medicolegal consequences, is limiting the general acceptance of spinal anesthesia.

One must remember that neurological complications may follow anesthesia other than spinal. Paraplegias, palsies, and meningeal infections have also been reported after general anesthesia. Pre-existing neurologic disease, such as tabes, combined degeneration and multiple sclerosis may be the causative factor. Thrombosis of the spinal artery may occur postoperatively incidental to the operation and not related to anesthesia. Neurologic sequelae are more frequent after the use of the continuous or serial spinal anesthesia, than the single injection technique.

Meningeal Infections

Infection of the meninges results from contamination. It is possible that an unrecognized pre-existing infection becomes manifest after the block and that the spinal anesthetic was incidental to the infection. The meningococcus is the most common organism found under these circumstances. The staphylococcus is the organism found when contamination is due to poor technique. The patient develops the classical signs of meningitis several days after the block. The diagnosis is made by examination of the spinal fluid. Epithelium from the skin and connective tissue from the interspinous ligaments has been identified in the spinal fluid. Presumably it is pushed into the subarachnoid space by the needle. Thorough cleansing of the skin at the site of puncture is important. Infection may result from improperly sterilized glucose, local anesthetic solutions, needles, gloves or drapes.

Backache

Backache is not a neurologic complication. However, it is one which is occasionally encountered after spinal anesthesia and considered along with neurologic complications. The etiology is difficult to determine. It is possible to advance the needle too far and traumatize a disk and cause herniation. Trauma to the interspinous ligament may occur also and cause backache. The periosteum may

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We Must Walk Together

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Nurse anesthetists are first of all professional nurses. Specialization has not dimmed their sense of responsibility for the purposes of nursing nor their abiding faith in its ideals. Hence my comments are directed to you as members of the nursing profession. The challenges and problems of nursing are at an unprecedented high. As a profession we urgently need not only a fuller perspective on our place in today's health program, but stronger convictions to guide us in setting up long term goals. We need a greater unity within our ranks in our moves toward these goals.

The primary issue before the profession is not personnel shortages, or the complexities of nursing education, or nurse welfare; these are problems. The issue is the need for greater solidarity in our approach to our responsibilities. Today our force is too diffused; we walk in too many directions; we talk to and at, but not enough *with* each other. Our struggle for independence was long; diffusion of our forces can jeopardize our right to decision. It can make us vulnerable to control by others. Old ideas about "handmaiden" service and apprenticeship die hard. We need to mobilize better our mental and spiritual powers, in order that we protect the standards representing our ideals in patient care.

By a generous estimate only half of the nurses in active practice belong to any professional nurses or nursing association; the remaining half walk alone, their ideas and ideals of no help to the profession. Three of our five national associations are devoted to specialties of a highly intensive nature. They are isolated, as associations, from participation in professional affairs, not for lack of interest, but because the 1952 structure reorganization made no provision for their participation.

Our two leading national associations—the American Nurses Association and the National League for Nursing—work together on a planned division of activities. But this division was based on activities already under way and on the new objectives indicated in modern trends. Beyond estimating trends in demand, however, nursing has taken no long, searching look into the scene ahead.

Professional nursing in this country has come a long way in a short time. Its whole life of less than 90 years has been lived in the most revolutionary changes in medical history.

It has moved from a nebulous apprenticeship to professional status. It has moved outward from its single bedside service in the hospital into an impressive variety of services to fellowmen wherever they are. In its practices and curriculum it has kept abreast of medical advances. It has developed specialties that demand high skills and judgment. It has integrated with health movements and become essential to all health projects.

Nursing has achieved well. But the time is come for it to take its second breath. Along with all mankind, nursing has entered a new era, rich alike in promise and problems. Because distances have been annihilated, the world is now one community—and the great need today is for men of all races and cultures to learn new lessons in cooperation. "A new type of thinking is essential if mankind is to survive and move to higher levels", said the great scientist, Einstein.

Just so is it with nursing, a branch of the health world, which too has become one community. With us, too, a new type of thinking is essential, if not for actual survival, certainly for the fulfillment of the profession's high purposes. And this new thinking must begin with the individual in order to permeate the associations through which the profession makes it progress.

We have been breathlessly busy with the business of sheer growth, of meeting pressures for more nurses, more skills, new kinds of services—and of getting the day's work done. Our thinking has been held in leash by the lingering tradition that passive obedience is the mark of a good nurse —a tradition that too often brought penalties to creative thinking. Too, nursing is intensive work that has focused our thinking on its *hows*—how to educate nurses, how to nurse, how to get more nurses, how to get the work done. This preoccupation with *doing* has blurred our understanding of some of the *whys* of our doing — and when we make major moves without such understanding we build up trouble.

In the early 30's for example, a series of events and movements brought overwhelming work loads and new responsibilities to hospital nurses. The success of the Blue Cross plan brought in a huge influx of patients. By that time doctors had transferred much of their practice to hospitals and their offices. Early ambulation and a wealth of new procedures quadrupled the orders on the books. Care became intensified and fast as patients moved in and out at a greater pace.

We did not ask if *all* this hospitalization was so necessary that professional nurses' care of patients must be thinned almost to the vanishing point. Nor if it was so necessary that thousands of nurses' helpers must be brought in in order to get the work done — the majority of the helpers utterly untrained in any of the disciplines of patient care. We weren't ready to ask these and other questions. Instead we bent to the task—and nurses' job satisfactions almost disappeared, while patients' complaints of impersonalized care mounted. Above all, the close nurse-patient relationship so vital to good care, was seriously disturbed. It will take a long time to clear away the troubles created by the headlong rush of those 20 years.

We now face a more complex world in which the potentialities for both progress and trouble are greater than ever before. Today's major health problem is chronic disease with its long and multiple demands. Today's major health purposes are the fullest possible restoration of the ill and handicapped, and prevention of disease. Progressive care is the objective in today's approach. Its aim is to classify and serve patients according to their individual needs for care, in contrast to the traditional routines that brought bed care, meals on trays, et cetera, alike to all. The hope is to improve care, cut costs, and to use nursing service more effectively.

Present experiments in intensive and self-care units and long-term facilities are marks of the trend. The USPHS recommends that progressive care be organized around five basic approaches — intensive care, intermediate care, self-care, long term care, and home care. There are many implications for nursing in this plan. The spread of patient care facilities in both the hospital and the community will call for more nurses and more types of nursing. The movement will receive strong impetus if Blue Cross benefits will cover convalescent and nursing home, home care and some aspects of out-patient care by the early 60's—as Blue Cross's president, Basil McLean, predicts it will.

The nursing problems involved in these moves are interrelated with other major problems, such as those of nursing administration, relationships, communications, nursing education, accreditation, licensure, and public relations, and legal protections. The need for new thinking among nurses and for greater cohesion and for participation in planning, becomes more pressing. Almost ten years ago Dr. Earl S. Johnson[1] charged: "Nursing must act more boldly. It must have a mind and it must speak it clearly and forcefully. It must initiate more and follow less. It must do this because, of all the professions serving the health of the people, it is closest to the people." It is time to heed him. Nurses, "closest to the people", must share in the planning as well as in the doing. Progressive care, for example, can become a blessing to the patient, but it can also become just another form of assembly line care. We need to help safeguard the patient as well as our own standards.

How do we create new thinking? How do we mobilize the judgments, ideas and ideals of thinking nurses, whatever field they represent — and from them develop convictions and objectives? The questions have especial pertinence at this time since the ANA has re-opened the 20 year old discussion on one overall national association "for nurses and nursing" and recommends action in learning how it can be done. The purpose is to create greater unity. The 1946-1950 costly and concentrated consideration of reorganization plans ended in a draw.

Why did the long efforts to create one overall association fail? Chiefly, I believe for three reasons. The planners put the cart before the horse—trying to build the vehicle before they knew what it had to do. The expanded responsibilities of nursing make it essential that we take stock of our new position, broader purposes

[1] Johnson, E. S.: Some Unfinished Business in Nursing. Am. J. Nursing, *50*:73, Feb. 1950.

and larger problems, *before* we shape the instruments needed for action. Further, the plans were built on the assumption that *only* through massing all nurses together can we get the professional solidarity we need. Third, the planners did not recognize the rise of specialist groups, a substantial part of the nursing force, whose internal affairs demand a larger degree of self government than can be provided within a parent association.

Will the present move for one national association fail too? I believe so, and for good reasons. First because NLN, supported by state league presidents, politely but firmly declined ANA's invitation to create a joint committee to learn how to form one organization. NLN's opinion was that the functions of ANA and NLN "seem best achieved through the two organizational structure." It would seem unjustifiable for any reason to interrupt NLN's present pace, and to re-align the positions and powers of its divisions and departments in another body. Its remarkable growth in seven years, the sweep of its activities and achievements, and the confidence it has inspired in its members, allies, and in the foundations which underwrite much of its research, all indicate that it is meeting vital needs.

Another reason for believing the effort will fail is that the reasons advanced for so costly a change are too vague to carry much weight. They have not been clearly identified and documented. The complaint of "duplication" brings the question—where? In the subject matter of meetings? Is there a major subject related to patient care that isn't many-sided—the concern in some aspect of every group in nursing? What other kinds of duplication exist? Two payments of dues? It seems incredible that so trivial a reason could be advanced for urging so mighty a change.

A fact that apparently has not been studied is that no other major profession has been able to enclose all its activities in one overall national association. Nursing's small handful of five national associations contrasts sharply with the 150 national medical societies open to doctors, the 75 open to engineers, and the scores open to educators. Further, the proponents fail to recognize that the growing demands for greater skills in all areas of human activity intensifies the trend toward more specialists, and more specialist associations. The number in all areas is growing steadily.

It is only natural that specialists in highly skilled fields set up their own associations. They have internal situations and problems that they alone can fully understand. They know what must go into their standards of education and practice. They have relationships with groups in other fields that require a freedom of action that only full self government can provide. Thus, a primary reason for setting up specialist associations is to insure full autonomy in internal affairs. Organized as sections in a larger body their autonomy must of necessity be limited, and their basic policies must fit those of the parent body.

Nursing needs something more potent than massed numbers to create unity. It is the meeting of minds and spirits on objectives common to all, regardless of *how* many associations are represented. We see recognition

of this fact in the growing number of joint meetings in which a variety of associations discuss a common problem. A Chicago meeting on "What is Good Nursing Care?" brought out a record crowd, showing the wide range of interest in the subject. The meeting was held under the aegis of the Chicago and Northeastern League for Nursing, and sponsored by two sections of District 1, Illinois Nurses Association, and the Chicago Council on Community Nursing. It was typical of many similar events.

That is the kind of unity that forms the convictions that lead to action. It is the kind we need in nursing. It's the unity in which the specialist groups can participate freely, yet retain control over internal affairs. It's the kind of unity that can consolidate for the common good the competence, judgment and good will within nursing. It can be achieved without costly, wearying discussions of framework and bylaws. Its cost is not in dollars but in new thinking—and if we will, we can have it tomorrow.

Stress, Adrenal Cortical Insufficiency, Anesthesia and Hydrocortisone

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Review of the Adrenal Glands

The adrenal glands are two small bodies lying behind the peritoneum; immediately above and anterior to the upper end of each kidney. Nerve supply consists of preganglionic fibers of the thorocolumbar division (via the splanchnic nerves), the vagus, and phrenic nerves. The left adrenal is usually slightly larger than the right. These glands are composed of two different distinct parts; the external portion, or cortex, and the internal portion, or medulla. The medulla secretes the hormone adrenalin, which contains norepinephrine. The cortex secretes approximately thirty steroid compounds, but exact physiological function of all these compounds has not yet been determined. Some of these functions include; electrolyte and water balance, capillary permeability, carbohydrate, protein and lipid metabolism, resistance to stress and toxins, growth, lactation and pigmentation, gonadal and renal function. Hydrocortisone accounts for about 80% of the circulating corticoids, corticosterone for 20%, and aldosterone for less than 1%. In both animal and human adrenal vein blood the major corticoid found is hydrocortisone. This report will discuss this steroid further.

A steroid may be defined as a group name for compounds which resemble cholestrol chemically, and contain a hydrogenated cyclopentophenantrene ring system. The steroid field of organic compounds consists of sterols, bile acids, sapogenins, sex hormones, cardiac glycosides, and adrenocortical hormones.

Hydrocortisone, Compound F., and plasma 17-hydroxycorticosteroid are terms for the same steroid. Metabolites of this steroid are excreted in the urine, mostly as conjugates of glucouronic and sulfuric acid, or in its pure form. The intermediate metabolism of cortisone is only partially known, but excretion of the administered dose is nearly complete within 12 hours. Metabolic effects of the glucocorticoids (to which hydrocortisone belongs) are: 1) maintenance of the hemostatic renal electrolyte mechanism, 2) elevation of blood sugar, 3) increase liver glycogen, 4) increase nitrogen loss, 5) counteraction of insulin activity, 6) reduction of capillary permeability.

In response to stress, activity of the adrenal cortex is greatly increased —probably in the following manner. Stress stimulates the higher brain centers (via the anterior hypothalmic nuclei), to stimulate the anterior pituitary, which then releases the adrenocorticotropic hormone (A.C.T.H.).

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This in turn stimulates the adrenal cortex to release adrenocortical steroids. Practically nothing is as yet known of the mediator which triggers response of the pituitary. In the stress syndrome, the factor of circulating 17-hydroxycorticoids is important because the tissue corticoids are used first, and the resultant lowering in concentration gives stimulus for the A.C.T.H. release. Therefore, as the level of hydrocortisone rises, a "feed back" signal to the pituitary results in cessation of A.C.T.H. production. During stress there is an increased output of epinephrine as well, which also stimulates the production of A.C.T.H. in a manner unknown at present. It is believed that epinephrine plays some part in the early phase of the alarm reaction.

The stress syndrome responds to any form of stimuli which causes change in the external, or internal environment of the patient. Operation, anesthesia, physical injury, muscular exercise, exposure to extreme heat or cold, drugs, acute infection, emotional or psychic trauma, or hemorrhage, result in increased production of corticoids either secondarily to an increase in A.C.T.H., or, as a result of direct stimulation of the cortex with epinephrine (via the sympathetic nervous system). Increased amounts of corticoids are necessary for the maintenance of fluid and electrolyte balance, carbohydrate metabolism and vasomotor tone. In adrenalectomized animals, normal sympathetic activity is still present, but muscle in the anterior wall appears unable to respond to sympathetic nerve impulse, or to topical application of norepinephrine. Responsiveness to norepinephrine can be restored by topical application of aqueous adrenalcortical extracts. If the adrenal cortex does not increase production and release of corticoids in response to stress, a state of adrenalcortical insufficiency, or so-called "adrenal shock" may ensue. The usual signs of adrenal cortical insufficiency are persistent hypotension to shock levels with failure to respond to adequate blood replacement and vasoconstrictors, respiratory depression, and a prolonged reaction time after anesthesia.

Adrenal cortical hypofunction should be anticipated in patients who have been chronically ill, who have a disease of the adrenals, or who have been on any type of steroid therapy. Adrenal cortical atrophy can occur secondary to corticosteroid therapy. Since it is believed that the concentration of the corticosteroids in plasma controls output of A.C.T.H. by the pituitary, exogenous cortisone (by increasing plasma steroids) depresses production of A.C.T.H., and thereby may cause atrophy of the adrenal cortex. There is evidence that atrophy can occur after only 25 mgm of cortisone daily for five days, and adrenal suppression may persist for an indefinite time. Therefore, any patient who has received steroid therapy for an appreciable period must be considered as susceptible to acute adrenal cortical insufficiency, and should be given prophylactic steroid therapy. Patients who have had steroid therapy within one year prior to elective surgery should receive prophylactic doses of cortisone, or hydrocortisone, intramuscularly starting 48 hours prior to surgery. Adrenocortical insufficiency may occur in spite of these measures. Patients with signs of adrenal hypofunction, when subjected to stress, will generally react favor-

ably and rapidly to the intravenous administration of hydrocortisone.

The danger of adrenal cortical insufficiency is great enough to warrant routine questioning of patients prior to surgery regarding previous steroid therapy.

Except in cases of extreme emergency, hydrocortisone is contraindicated for the following groups of patients:

1) tuberculous patients — hydrocortisone has an inhibitory effect on the function of fibroblasts and granulation tissue, and decreases the body's response to infection.
2) patients with chronic nephritis —sodium retention may occur, causing increased retention of water and edema. Inability of the nephrotic patient to diurese requires caution.
3) acute psychotics—an unpredictable variety of reactions may be produced; ranging from euphoria, mental excitement, or restlessness, to depression, or frank psychosis.
4) Cushing's Syndrome — caused by an already overactive adrenal gland.
5) peptic ulcer patients—administration of adrenocortical steroids causes an increase in hydrochloric acid and pepsin secretion, and delays healing.
6) those having congestive heart failure, or hypertension — because electrolyte and fluid retention may occur.
7) diabetics — given this steroid these patients will manifest an increase in glycosuria, and hyperglycemia (controllable by increasing insulin dosage).

In addition, hydrocortisone therapy prevents localization of infection by depression of the body's anti-inflammatory response, interferes with wound healing, seems to depress the host defense mechanism against infection, may actually disguise the symptoms of an acute disease, and increases the incidence of thromboembolism.

A study of the effect of anesthesia on plasm levels of circulating 17-hydroxycorticosteroids was conducted at the University of Colorado School of Medicine by Virtue et al.[8] Following are some of the facts reported.

In their study, seventy patients were used, ranging in age from 5 to 81 years, and whose operations varied from minor to extensive major procedures. Of these seventy patients, thirty-five were maintained on ether, fifteen received thiopental—nitrous oxide, ten received cyclopropane, and ten were given spinal anesthesia. Plasma samples were drawn before induction, after one hour of anesthesia, and after one hour of surgery. Various tests were performed to determine the levels of the free 17-hydroxycorticosteroids, and of conjugated steroids. Preoperative medications, or apprehension did not appreciably alter the preanesthetic plasma levels of the steroid. It was shown that the administration of cyclopropane, thiopental—nitrous oxide, and spinal anesthesia did not appear to effect any significant degree of adrenocortical activity during the period of anesthesia. Of these thirty-five patients, only three showed any appreciable rise in the corticoid levels, two under pontocaine spinal, and one under thiopental—nitrous oxide. In contrast, fifteen of the thirty-five patients receiving

ether had a definite rise in the plasma corticoid levels. Thus, the study revealed that although increased adrenal activity may occur during ether anesthesia, the response is not uniform. Under spinal anesthesia the afferent impulses are blocked from most of the body, and the surgical field; therefore, there might not be a stimulation of the adrenals. This indicated then, that ether produces the greatest rise in hydrocortisone levels, while cyclopropane, and thiopental—nitrous oxide produced the least of the general anesthetics. In addition, none of the inhalation agents suppressed the response of the adrenal cortex to the trauma of surgery. Surgery caused a significant rise in these levels in all the patients, and the values rose even more following surgery. Anesthesia appeared to be a minor form of stress, while surgery appeared to be a major stress. The normal patient reacts favorably by increasing adrenal activity, while the patient who comes to surgery with inadequate adrenal activity may be unable to meet the challenge of any stress, and may develop fatal circulatory complications.

In conclusion, the importance of knowing a patient has had previous steroid therapy within a year is stressed. With this knowledge, adrenocortical insufficiency can be anticipated and handled promptly by administration of intravenous hydrocortisone if necessary. Team work between medical doctor, surgeon and the anesthetist is important in coping with a problem on which many questions are still to be answered.

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Legislation

Emanuel Hayt, LLB., Counsel A.A.N.A.

No Cause of Action for Patient's Fall from Hospital Bed without Proof of Need for Side Rails

This is an appeal from a final judgment based on a directed verdict in a negligence action. Marie M. Marsh sued the City of St. Petersburg for injuries sustained when plaintiff fell out of bed while a patient in defendant's hospital. At the conclusion of plaintiff's evidence at the trial, the trial judge directed a verdict for defendant. Plaintiff appeals.

Plaintiff, a seventy year old woman, suffered a heart attack at about twelve noon on May 7, 1955. Her doctor gave her a sedative and had her removed to defendant's hospital. She arrived at about 12:50 p.m. Plaintiff does not remember anything that occurred between the time she received the sedative and about five a.m. the next morning, May 8, 1955. At that time she awoke in her hospital bed, and realized she was vomiting and gagging. She attempted to ring for a nurse, and though she "nearly pulled the bell cord out of the wall," no one came. She then tried to get to the foot of the bed, but she had difficulty because of an oxygen tent which was over her. She finally got free and struggled towards the foot of the bed, vomiting all the while. She intended to call a nurse, but upon getting near the foot of the bed, she was seized with a particularly bad vomiting spell and fell out of bed onto her back. All of this took about twenty minutes. When she fell she screamed, and a nurse immediately came into the room, put her in a chair, had the mess cleaned up, and returned her to bed. Plaintiff suffered a broken rib and a compressed fracture of the spine.

There being no testimony that reasonable care on the part of the nurse or the hospital under the circumstances shown in this case required the installation of bed rails, the evidence was insufficient to warrant the submission of this issue to the jury.

Affirmed.

(Marsh v. City of St. Petersburg, 8 CCH Neg. Cases 2d 1220-Fla.)

Unnecessary Breast Amputation, Without Pathological Examination for Cancer, Held not Negligence

This is an appeal from a judgment for defendant rendered upon a verdict by a jury in a malpractice action growing out of an alleged unauthorized and unnecessary mastectomy.

Instructions fixing defendant's liability if he operated without plaintiff's consent or after revocation of her consent were given. Instructions fixing defendant's liability in the event of his failure to follow standard practice in the community were cov-

ered to the extent necessary in other instructions. Expert evidence as to there being a standard practice in the community was all negative.

The language was used in support of this court's conclusion that factual issues had been made requiring a jury determination, both as to the consent or its withdrawal and as to whether or not there was negligence in the removal of plaintiff's breast without pathological examination.

Affirmed with costs.

(Corn v. French, 8 CCH Neg. Cases 2d 1238-Nev.)

Death Caused by Spinal Anesthetic Is not by "Accidental Means" Under Double Indemnity Provisions of Policy

As a result of a spinal anesthetic which was administered before an operation, the insured died. The spinal was given by means of a hypodermic needle, physical force being exerted externally against the insured's back and spinal cartilage. It was established that the insured consented to the spinal and that it was administered properly in all respects. But the insured had a hypersusceptibility to this drug, such condition being unknown to him or the surgeon.

This suit was brought on several policies which were issued by the insurer, all the policies containing a double indemnity provision. Each policy provided that double indemnity would be payable if ". . . the death of the insured resulted directly and independently of all other causes from bodily injury effected solely through external, violent and accidental means. . . ."

In the trial court a judgment was entered in favor of the insured. On the appeal taken by the insurer, the issue as agreed to by both parties was "Where the insured voluntarily consents to the administration of spinal anesthetic, and such spinal anesthetic is properly made and administered, and the insured dies as a result of the administration of the spinal anesthetic due to hypersusceptibility of the insured to the anesthetic agent, is his death caused solely through external, violent and accidental means and independent of any infirmity of body or any illness or disease?"

In reversing the decision of the trial court, the appellate court noted that the act of administering the anesthetic was performed voluntarily and exactly in the manner intended. Consent was given by the insured and there was no slip or mishap. The means used were intentional and not accidental; therefore, even though the result which followed was unusual, unexpected or unforseen, it was not sufficient to establish liability under the policy.

(New York Life Insurance Company v. Bruner. Indiana Appellate Court. October 30, 1958. 4 Life Cases (2d) 1.)

Court Holds Expert Testimony Is not Required to Prove Leaving Foreign Substance in Wound Is Negligence

About a year after Dr. Fishback performed an appendectomy on Ronald W. Young, an abscess the size of a small egg had developed on the scar. After Dr. Fishback operated again to relieve the abscess, this action for alleged malpractice was filed against him by the patient and his wife.

The theory of the plaintiffs was that a foreign body had been negligently left in the wound at the time of the first operation and had caused the abscess. Plaintiffs did not pro-

duce any direct testimony that a foreign substance was found in the course of the second operation, but relied upon Ronald Young's own testimony and the testimony of his father, both reciting statements to that effect allegedly made to them individually by Dr. Fishback. The doctor denied making any admissions, and said he found no foreign substance when he reopened the wound. It can be inferred from the testimony of the plaintiffs at least that a small portion of or a few threads from a piece of gauze had been left in the first incision by the doctor. According to the evidence, such material will not be absorbed.

The trial judge interrupted the argument of plaintiff's counsel, took the case from the jury, and directed a verdict for the defendant doctor, because the plaintiffs had not produced expert testimony to show that leaving a small bit of gauze or a few threads in the wound is not in accord with the degree of skill and care common to surgeons in this locality.

We think the court erred in taking the case from the jury. Everybody knows, without being told by an expert, that it is not approved surgical practice to leave in a patient's body a small bit of gauze or a few threads therefrom, or any other foreign nonabsorbable substance, no matter how small. It was for the jury to say whether the defendant had left even a small piece of gauze or other foreign substance in the wound and had thus caused the abscess.

Reversed and remanded for a new trial.

Dissenting Opinion

It seems to me my brethren go too far in this opinion. The difficulty arises from the way in which they state the proposition. They say "Everybody knows . . . that it is not approved surgical practice to leave in a patient's body a small bit of gauze . . . or any other foreign nonabsorbable substance, no matter how small." Of course the fact that a foreign substance is left in a wound is not approved by the medical profession. But the question is whether the surgeon's procedure is approved regardless of whether or not it has an unfortunate incident. I would suppose that in many operations calculated risks must be taken. Failure does not necessarily reflect on the surgeon. Of course a procedure which would risk leaving scissors or clamps in a wound is clearly unreasonable, but a procedure which risks leaving a single fiber from a thread does not seem to me to be so clearly unreasonable. The point is that the question before the court is not whether the result, or a by-product, of an operation is approved by the medical profession but is whether the surgeon followed approved procedure. For this reason the presence of a few threads of gauze is not of itself prima facie proof that the cause was a departure from that degree of skill and care approved by surgeons. I am unable to say how minutely a surgeon should examine a sponge before, during and after an operation, how carefully he should avoid cutting a few threads from the sponges, how thoroughly he should explore a wound before closing the incision. It may be that if he did these things as surgeons think they should be done the foreign body would not have been left. But perhaps the exercise of all the care

surgeons think is reasonable would not have prevented the unfortunate occurrence. The jury needed expert testimony on this point. Without such testimony there was no prima facie of departure from approved surgical practice.

(Young v. Fishback, 8 CCH Neg. Cases 2d 1398-USCA-DC)

ANNUAL MEETING

1959

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ADRIANI *(Continued from Page 118)*

be traumatized after repeated attempts at lumbar puncture and may cause the backache. More than likely the backache is due to pre-existing orthopedic disturbances and is not related to the spinal anesthetic. Relaxation of skeletal structures from anesthesia while the patient is on the operating table or confined to bed in the postoperative period may have some bearing upon its appearance postoperatively. Frequently pre-existing backache is aggravated by loss of muscle tone or relaxation of the ligaments. Backache, of course, is frequently seen in many surgical patients irrespective of the type of anesthesia.

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"Our problem is this, small operating rooms, motor driven suctions, bovies, cautery, extension cords, non spark proof outlets, non-conductive clothing on most if not all personnel. We realize the ether oxygen hazard. However, ether makes up a small percentage of our anesthetics whereas cyclopropane, nitrous oxide and oxygen in an open system is being given routinely with the theory that the nitrous oxide renders it non-explosive."

The belief expressed in this theory is based on fallacy. The flammability ranges of ether and of cyclopropane are very much the same. A mixture of cyclopropane as lean as 2.4% in air (20% oxygen and approximately 79% nitrogen) is flammable. As little as 1.9% of ether in air can be ignited.

The flammability range of cyclopropane in nitrous oxide alone without the added oxygen needed for anesthesia purposes is greater than that of ether, being from 1.6% to 30% while that of ether is 1.5% to 24%. And according to Adriani 4% cyclopropane is necessary to produce analgesia and up to 20% needed to produce surgical anesthesia. In the case of ether, surgical anesthesia is present when there is 4% ether in the alveoli. So it is readily seen that anesthetic ranges and flammability ranges are about the same.

Nitrous oxide itself supports combustion. Mixtures of nitrous oxide with ether or cyclopropane will ignite and continue to burn because nitrous oxide readily gives up its oxygen component to support combustion. These are all facts which have been and can be proved.

For the sake of argument let us suppose that a mixture of cyclopropane, nitrous oxide and oxygen is being used with the exhaust valve wide open and that this mixture is too rich to burn. It will take but a very short distance, measured in inches, for the room air to dilute such a mixture to the flammable range, and in this case the entire area immediately adjacent to the mask and patient's head will be filled with a potential fire and explosion hazard. If on the other hand the mixture is too lean to ignite, then the mixture will also be too weak to produce anesthesia.

Some of the hazardous conditions mentioned in this writer's letter are easily corrected. For instance, it is a simple matter to wear cotton uniforms and slips, and many hospitals furnish cotton gowns, pants and shirts for operating room and delivery room use. A number of manufacturers put out motor driven suctions approved by Underwriter's Laboratories for use in areas where flammable anesthetics are to be used.

Hospital managements have been held responsible legally in case of disaster for not enforcing safe practices where flammable anesthetics are used. Following all of the rules and regulations as set forth in N.F.P.A. #56 will provide the presently known safeguards which help to eliminate the fire and explosion hazard where flammable anesthetics are used. Complying with only a portion of the requirements can lull people into a false sense of security.

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Book Reviews

Anatomy and Physiology Laboratory Manual. By Catherine Parker Anthony, B.A., M.S., R.N., Assistant Professor of Nursing, Science Department, Frances Payne Bolton School of Nursing, Western Reserve University; Formerly Instructor of Anatomy and Physiology, Lutheran Hospital, Cleveland, Ohio; Instructor of Anatomy and Physiology, St. Luke's Hospital; Assistant Instructor of Anatomy and Physiology, Frances Payne Bolton School of Nursing, Western Reserve University. St. Louis, Missouri: The C. V. Mosby Company. Paper. 320 pages. 5th ed., 1959. $3.50.

The fifth edition of this manual has been revised to help students better understand the subject. Time saving features for instructors are also included. The author presents the procedures in entirely new format. Each problem to be studied is stated. Directions, space for recording data, and questions to help draw the conclusion are provided.

Suggestions to students, laboratory equipment, and sources for procuring equipment are listed following the table of contents. This practical laboratory guide will be of special value to nurse anesthetists who are concerned with teaching.

Physiology of Spinal Anesthesia. By Nicholas M. Greene, B.S., M.A., M.D., Professor of Anesthesiology and Lecturer in Pharmacology, Yale University School of Medicine; Director of Anesthesia, Grace-New Haven Community Hospital. Baltimore: The Williams & Wilkins Company. Cloth. 195 pages. 1958. $6.00.

Dr. Green has presented a comprehensive appraisal of the literature on this subject. This monograph reviews and evaluates reports which appear in the literature dealing with the physiological response to spinal anesthesia or to surgery being performed under spinal anesthesia.

All anesthetists and physicians will find this text of value. The author emphasizes that the benefits of spinal anesthesia cannot be fully realized unless the physiological effects are understood and the physiological limitations appreciated.

Of special interest to the anesthetist is the chapter on Obstetrical Physiology which discusses the Effects of Spinal Anesthesia on Maternal Physiology; the Effects of Spinal Anesthesia on the Fetus and the Role of Spinal Anesthesia in Obstetrics.

References follow each chapter. Indexed.

Fundamentals of General Anesthesia for Students and Practitioners of Dentistry. By John Adriani, M.D., Professor of General Anesthesia, School of Dentistry, Loyola University; Professor of Surgery, School of Medicine, Tulane University; Clinical Professor of Surgery and Pharmacology, School of Medicine, Louisiana State University; Director, Department of Anesthesia, Charity Hospital, New Orleans, La. Springfield, Ill.: Charles C Thomas. Cloth. 213 pages, Illustrated. 1959. $6.50.

Dr. Adriani has compiled material based largely on his lectures to students and practitioners in Dentistry. He presents the physiology, pharmacology, indications, types of drugs, preparations, hazards and the complications of general anesthesia which apply to dentistry and oral surgery.

The author emphasizes that the dentist must be familiar with the hazards of general anesthesia if he is to prescribe it for patients even though he does not administer the anesthetic.

Designed for students and practitioners of dentistry, this book will also be of interest to anesthetists, especially those who work with dentists or oral surgeons.

References follow the text. Indexed.

CYCLOPROPANE ANESTHESIA. By Benjamin Howard Robbins, B.A., M.S., M.D., Professor of Anesthesiology and Associate Professor of Pharmacology, Vanderbilt University School of Medicine; Anesthesiologist - In - Chief, Vanderbilt University Hospital. Baltimore: The Williams & Wilkins Company. Cloth. 293 pages. 2nd ed., 1958. $9.00.

The second edition of this valuable text follows the first edition by eighteen years. Since the first edition many studies have been made and reported. Dr. Robbins has evaluated the literature and presents the facts about cyclopropane.

Major changes have been made in most all of the text, especially the chapters on The Concentrations of Cyclopropane Required for the Different Levels of Anesthesia and for Respiratory Arrest; The Effects of Cyclopropane Anesthesia upon the Circulatory System; The Effects of Cyclopropane Anesthesia upon the Respiratory System and The Clinical Administration of Cyclopropane.

Due to the widespread use of the relaxants since their introduction, a chapter has been added on The Relaxing Agents. New figures and tables have also been added and the bibliography includes many new titles.

This book will be a most welcome addition to the anesthetist's library. Indexed.

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Abstracts

Hara, Masauki, Harberg, F. J. and Hudson, L. H.: Antifibrillatory action of piperidolate hydrochloride (Dactil) in hypothermia. Arch. Surg. 75: 780-784 (Nov.) 1957.

"This study is concerned with an evaluation of the antifibrillatory activity of the drug piperidolate hydrochloride (Dactil; N-ethyl-3-piperidyl diphenylacetate hydrochloride; JB-305) in hypothermic dogs. . . .

"The drug . . . has a pronounced antifibrillatory effect upon the myocardium of the hypothermic dog. The drug prevented fibrillation in 26 of 34 hypothermic dogs in which the procedure of ventriculotomy or the creation of an interventricular septal defect was carried out. There were but 10 survivors out of 23 animals undergoing the production and closure of an interventricular septal defect, ventricular fibrillation developing in 6 of the dogs."

Bernard, H. R.: Hazards and safeguards in the use of parenteral replacement fluids. S. Clin. North America, pp. 1447-1458 (Oct.) 1957.

"Safeguarding against the hazard of overusing parenteral fluids is simply a matter of critical reflection upon the question of whether the proposed treatment is necessary or advisable. Once the decision is made to employ parenteral fluids, hazards are encountered from the moment that the preparation of the fluid is begun until the infusion is completed and its effect sustained in the patient. . . .

"Hazards associated with preparation and storage of parenteral solutions are related to (1) contamination with infective material, (2) the presence of pyrogenic substances, (3) qualitative and quantitative errors in preparation, and (4) errors in technical processing, packaging and labeling. . . .

"The hazards involved in the technical administration of parenteral fluids include (1) damage done by the needle puncture, (2) injury to veins or surrounding tissues by the solution introduced, (3) introduction of infective, pyrogenic or foreign material, (4) air embolism and (5) human error and faulty handling of fluid reactions. . . .

"The hazards associated with blood and plasma have to do with the immunologic reactions and the osmotic effect of the protein plus the salt solution vehicle. . . . The parenteral administration of foodstuffs still falls short of ideal complete replacement because of the large mass of fluid necessary to provide caloric needs. Replacement is hampered by difficulty in production of material identical to that circulating in the normal plasma. The more easily that this may be accomplished, as with dextrose, the less hazard is encountered; the less closely, as with fat, the more hazard. Vitamin solutions used in the usual amounts cause little difficulty. Large doses of vitamin D, however, given over a prolonged period will produce renal calculi. Protein solu-

tions must be administered in the form of amino acids, which should be given slowly to avoid raising the serum concentration above the renal threshold, and to avoid the systemic symptoms of nausea and fever sometimes seen with more rapid administration. Hypoglycemia is seen many times following the discontinuance of glucose administration, especially if concentrated solutions have been employed for some time. All such material should be given relatively slowly and the patient carefully observed for reactions of febrile or allergic nature. . . .

"Solutions given to replace extracellular fluid should reflect as nearly as possible the losses in volume and composition . . . Hypertonic electrolyte solutions should be given only on definite indication and should not exceed one molar in concentration . . . The administration of hydrochloric acid or ammonium chloride in the treatment of metabolic acidosis is hazardous and the desired effect usually may be accomplished more safely through the administration of sodium or potassium chloride, relying upon the kidney for further adjustment. . . .

"When fluid combinations are used the greatest danger is that the individual actions will be neglected and either too much or too little effect of the secondary substances will be observed. . . .

"Hazards referable to the pathological state (include) . . . 1. Overloading the extracellular fluid compartment. . . . 2. Alteration in electrolytic.osmolar concentration . . . (and) 3. Alterations associated with treatment of acid-base balance and specific ionic concentration. . . .

"We, as physicians, must be ever mindful of these complications so that we do not attempt to divest ourselves of responsibility to our patient, simply because we do not ordinarily perform the actual administration of parenteral solutions. We must be constantly critical of materials and techniques and willing to instruct and supervise our house staff. Lastly, we must be ever cautious to employ parenteral treatment only so long as effective or necessary, realizing exactly what is being given and being accomplished."

Burn, J. H., Epstein, H. G., Feigan, G. A. and Paton, W.D.M.: Some pharmacological actions of fluothane. Brit. M. J. 2: 479-483 (Aug. 31) 1957.

"In the first pharmacological studies of fluothane, by Raventos (1956), it was established that this vapour could produce a rapid, effective, and flexible anaesthesia. It appears to possess, however, some unusual features when compared with other anaesthetics. First, it has a distinct hypotensive action. . . . Secondly, the effects of the anaesthetic appeared to pass off rapidly, and this recovery depended little on the duration of exposure. . . .

"In the following experiments (1) the effect of fluothane on the cardiac output has been studied; (2) the extent to which the fall in blood pressure could be attributed to ganglion block has been analysed further; (3) since fluothane undoubtedly possesses some ability to paralyse ganglia, a test of its actions on another cholinergic synapse, the neuromuscular junction, has also been made; (4) finally, evidence about the time course of its actions has been obtained. . . .

"For experiments on cardiac output, the dog heart-lung preparation was set up, ventilated by a Starling respiration pump. . . . For the experi-

ments on autonomic ganglia, the blood pressure, the neuromuscular junction, and the knee-jerk, cats anaesthetized with chloralose after induction with ethyl chloride and ether were used. . . . To obtain known concentrations of fluothane, modified E.M.O. inhalers calibrated for fluothane were used. . . .

"Fluothane reduces cardiac output in the dog heart-lung preparation. It is about 70% as active as chloroform in this respect. Fluothane lowers the blood pressure, in the cat under chloralose, more than can be readily accounted for by ganglion block. It is equally active in the animal in which the splanchnic vascular bed is removed by evisceration. Fluothane depresses the knee-jerk of the cat under chloralose in concentrations from 0.5% upwards. The intensity of this depression, together with its time course, corresponds sufficiently with that of the hypotensive action to suggest that the latter is produced by depression of central vasomotor mechanisms.

"Fluothane, though not itself strongly ganglion-blocking, potentiates ganglion block by hexamethonium and d-tubocurarine. Fluothane up to 4.5% does not paralyse the neuromuscular junction; but it antagonizes suxamethonium and potentiates d-tubocurarine."

Harris, S. C. and Worley, R. C.: Analgesic properties of xylopropamine. Proc. Soc. Exper. Biol. & Med. 95: 212-215 (June) 1957.

"Information that sympathomimetic drugs are analgesic has been accumulating for more than 50 years. . . . According to reports from the manufacturers' laboratories, xylopropamine sulfate . . . is one-third to one-fifth as stimulating as dextroamphetamine. Thus, evaluation of its analgesic properties seemed appropriate. . . . Each of 8 male human volunteers served for 4 experiments. . . .

"Xylopropamine sulfate . . . has been found capable of elevating the threshold of human subjects to experimentally induced pain. The method employed was electrical stimulation of the tooth pulp. . . . Five and 10 mg. oral doses of xylopropamine were compared with a placebo and a 'dry-run.' The average effect of the 10 mg. dose was statistically superior (P .05) to the effects of the other treatments from 90-180 minutes after medication. It is provocative that xylopropamine is analgesic but apparently not analeptic, while amphetamine is both. It suggests that the two effects on the sensorium could be independent."

Rankin, J., Mehnert, J. and Curreri, A. R.: Effect of levallorphan tartrate on levorphanol tartrate analgesia in postoperative patients. Arch. Surg. 74: 620-605 (April) 1957.

"After major thoracic surgery it is important to provide efficient analgesia without the hazard of respiratory depression. In 1952 Fromherz and Pellmont suggested, on the basis of animal experiments, that there may exist a ratio at which the respiratory depression induced by levorphan tartrate (Levo - Dromoran Tartrate) could be counteracted by levallorphan tartrate (Lorfan Tartrate) without significant loss of analgesia. . . .

"Cullen and Santos reported favorably on a combination of 10 parts of levorphan tartrate and 1 part of levallorphan tartrate in patients with chronic pain. The present study rep-

resents an attempt to evaluate this combination in patients after major thoracic surgery. . . . The clinical material consisted of consecutive adult patients undergoing pulmonary resection for pulmonary tuberculosis. . . .

"The slight decrease in respiratory depression and analgesia produced by the addition of levallorphan tartrate is probably not clinically significant, and at the same time the incidence of nausea and vomiting appears to be increased. The use of levallorphan tartrate should be reserved for the treatment of respiratory depression when it occurs after the administration of opiates."

BEER *(Continued from Page 106)*

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NURSE ANESTHETIST—Full time O.B. Anesthesia — Henry Ford Hospital, 2799 W. Grand Blvd., Detroit 2, Michigan. Write or call Mr. G. Delaney, Personnel Director, TR 5-2900.

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REGISTERED NURSE ANESTHETISTS: Immediate openings for permanent employment. 670 bed hospital. Exceptional opportunity for well trained Nurse Anesthetist in active operating room suite. Apply: Personnel Director, Harper Hospital, Detroit 1, Michigan.

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NURSE ANESTHETIST for old established 24 member clinic group. Additional modern hospital facilities under current construction. Applicant desired who can qualify for $500.00 per month salary or better. Usual vacation and sick leave benefits. Write Walton Goode, Business Manager, Hertzler Clinic, Halstead, Kansas.

NURSE ANESTHETIST: who prefers to do quality service in Pediatric Anesthesia in 100 bed hospital fully accredited. Located on Medical School Campus and affiliated with two Medical Schools. Liberal salary with three weeks vacation plus bonus days for years of service. Address inquiries to Dr. Dean Watland, Director of Department of Anesthesiology, Childrens Memorial Hospital, 44th and Dewey Ave., Omaha, Nebraska.

NURSE ANESTHETIST wanted for staff at the Confederate Memorial Medical Center, Shreveport, La., a 900 bed charity hospital. Department headed by a full time certified Anesthesiologist. Ideal hours and working conditions, Civil Service. Salary $440 to $460 to start. Write M. A. Kutschbach, M.D., Director of Anesthesia.

NURSE ANESTHETIST—Excellent working conditions, starting salary $450.00 to $550.00 depending on training and experience. Liberal vacation, sick leave and other employee benefits. Lexington is located in "The Heart of the Bluegrass" famous for horse racing and tobacco industries, home of the University of Kentucky and Transylvania College. Apply: Assistant Administrator, Methodist Good Samaritan Hospital, S. Limestone St., Lexington, Kentucky.

NURSE ANESTHETIST: 381 bed General Hospital, fully approved. M.D. Anesthesiologists. Salary $450-$500 per month. Forty hour week; 12 Sick Day leave; Vacation; six paid holidays; Social Security and Pension Plan. Apply: Anesthesia Department, Grace Hospital, Northwest Unit, 18700 Meyers Rd., Detroit 35, Michigan.

WANTED: Two nurse anesthetists to complete staff in accredited 200-bed general hospital, located in suburb of Capital city of West Virginia. Call on rotation basis. Living quarters available in modern nurses' residence. Air-conditioned working areas. Excellent salary and personnel policies. Attendance at professional meetings encouraged. Apply George I. Mattix, Administrator, Herbert J. Thomas Memorial Hospital, South Charleston, West Virginia.

NURSE ANESTHETIST: 525 bed Hospital. Good salary and working conditions. Air conditioned operating rooms. All agents and techniques used. 10 full time anesthetists. Rotating call every 7th night, with day off following call. Contact, Mildred H. Hodges, C.R.N.A., Missouri Baptist Hospital, St. Louis 8, Missouri.

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NURSE ANESTHETIST, 93 bed, fully accredited general hospital on Southeastern coast. Starting salary $400.00 per month plus meals and room, $25.00 increase in 6 months and 1 year. Two weeks vacation per year. Two in department. No surgery scheduled Saturday nor Sunday and no O.B. call. Average 100 cases per month. Liberal sick leave and 6 holidays per year. Hospitalization insurance paid. Under Social Security. Apply Box B-32, Journal American Association of Nurse Anesthetists, Prudential Plaza, Suite 3010, Chicago 1, Ill.

NURSE ANESTHETIST wanted for a 70-bed general hospital. $500 per month, 5½ day week, 2 weeks paid vacation, sick leave, meals and launder of uniforms. Please contact the Administrator of Memorial Hospital, Dumas, Texas.

ANESTHETIST, nurse, registered, female, by June 15, 1959. To serve also as Chief Nurse and Supervisor. $600.00 monthly. Supervisory experience desirable. 12 bed general hospital in mining town; staff of 20, including 7 RN's. Must be adept at inhalation, intratracheal, spinal, and intravenous techniques, and capable of independent judgment. Age under 50 years. Employment for husband usually available. Good school, low rental housing, excellent climate. Apply Richard G. Hardenbrook, M.D., Bagdad Hospital, Bagdad, Arizona.

NURSE ANESTHETISTS (2) — One each for Surgery and Obstetrics. Basic 40 hour week. Salary to $550.00 per month. Overtime pay. Vacation benefits to four weeks annually. Sick benefits in cash payment. Pension retirement. Write Personnel Department, St. Joseph Mercy Hospital, 900 Woodward Ave., Pontiac, Michigan.

WANTED: Nurse Anesthetist. 173 bed hospital located in Midwestern University Town of 130,000. Hospital fully accredited. School of Nursing. Building program contemplated. Starting salary $500.00 for Registered Nurse Anesthetist. Call quarters in Hospital. Write William C. Lightburn, Lincoln General Hospital, 2315 S. 17th St., Lincoln, Nebraska.

NURSE ANESTHETISTS — for 400 bed General Hospital. Good salary, vacation and working conditions. Under the supervision of an M.D. Anesthesiologist. Apply Personnel Office. Providence Hospital, 2500 W. Grand Blvd., Detroit 8, Michigan.

NURSE ANESTHETIST: Starting salary for A.A.N.A. member $415 per month with three annual increases of $15 per month to $460 per month after three years. Starting salary if not member of A.A.N.A. $380 per month increased to $415 per month after accepted as member of A.A.N.A. Also included: laundry, private room with bath and telephone in new women's residence or $27 per month allowance if living out; Social Security; pension plan; 40 hour week including full time credit for first call, second call paid for cases done; six paid holidays; 30 days annual vacation; liberal sick leave policy. Apply: Marshall Kerry, M.D., Chief Anesthesiology, The Reading Hospital, Reading, Pa.

REGISTERED NURSE ANESTHETIST. Excellent working conditions in modern 132-bed hospital. Friendly community with two colleges. Beginning salary $500 plus call pay. Apply Ralph B. Bersell, Administrator, Passavant Memorial Area Hospital, Jacksonville, Illinois.

NURSE ANESTHETIST: Immediate openings in fully accredited 300 bed general hospital for Nurse Anesthetist in city of 55,000 and serving area of 300,000 population. Paid vacation and sick leave, Social Security and group hospitalization available. Reply stating education, experience, and salary requirements to Assistant Director, Lima Memorial Hospital, Lima, Ohio.

NURSE ANESTHETISTS—Immediate openings in Minneapolis' finest hospital. Salary commensurate with qualifications. Contact D. E. Baumgardner, Director of Personnel, St. Mary's Hospital, 2414 S. 7th St., Minneapolis, Minnesota.

ANESTHETIST, NURSE: To cover surgery and OB in 275 bed hospital with expansion program in process. Excellent facilities and personnel policies. Salary open. Call or write Personnel Director, 810 E. 27th St., Minneapolis 7, Minnesota. Phone FEderal 2-7266.

WANTED: Nurse Anesthetist, salary approximately $450.00 per month, opening May 1, 1959. For further information write W. Forest Powell, M. D., University Hospital, Alcoa Highway, Knoxville, Tennessee.

NURSE ANESTHETIST — Additional Anesthetist wanted for new 1000 bed NP VA Hospital with 161 GM & S beds. Air conditioned operating rooms. Ideal working conditions, sick leave, annual leave and life insurance benefits. Salary—depending on training and qualifications. Apply to Personnel Officer, V. A. Hospital, Topeka, Kansas.

NURSE ANESTHETISTS WANTED for 57 bed hospital. Two anesthetists employed. Salary open. Details on request. Contact: Administrator, Sid Peterson Memorial Hospital, Kerrville, Texas.

NURSE ANESTHETIST — AANA desired. 245 bed accredited general hospital. Staff of five anesthetists. Rotating call. Air conditioned surgical suite. Excellent starting salary. Nursing quarters available. Write Assistant Administrator, Memorial Hospital, Casper, Wyoming.

ANESTHETIST NEEDED: Thirty major, twenty minor, and 30 O.B. anesthetics — average work needed per month here in our new, modern 35 bed hospital. Nice salary. Relief available for days off, vacations, sick leave, etc. Please contact Ward Memorial Hospital, Monahans, Texas.

NURSE ANESTHETIST to complete staff of five for 260 adult bed hospital, expanding to 500 soon, located near business district, Akron, Ohio. Surgery and OB. No call except relief. Forty hour week, extra for overtime. Four weeks vacation after year. Base pay after boards $450.00, qualifications and experience govern salary offer. Apply: Administrator, St. Thomas Hospital, 444 N. Main St., Akron, Ohio.

NURSE ANESTHETIST: Well qualified and experienced for 50 bed hospital. Salary open. Contact Administrator, Municipal Hospital, Clarinda, Iowa.

NURSE ANESTHETIST WANTED — 520 bed General Medicine and Surgery Hospital affiliated with Vanderbilt Medical School. Active teaching program. Write: Manager, Veterans Administration Hospital, Nashville, Tennessee.

NURSE ANESTHETISTS — Female, C.R.N.A. or eligible for C.R.N.A., University Medical Center. Salary depending on experience. Bonus of $10.00 for weekday calls, and $12.50 for Saturday and Sunday. Four weeks vacation with pay. Major Medical Care, Social Security, Metropolitan Retirement. Contact Chief Nurse Anesthetist—Mrs. Helen M. Geiss, Strong Memorial Hospital, 260 Crittenden Blvd., Rochester 20, New York.

ANESTHETIST - 330 bed voluntary general hospital - not tax supported. Modern air-conditioned surgical suite. Excellent working conditions. Room and board available if desired. Staff consists of 6 nurse anesthetists under supervision of 3 anesthesiologists. Salary open. Apply Decatur & Macon County Hospital, Decatur, Illinois.

NURSE ANESTHETISTS for 220 bed community hospital. Working with private group. Two full time M.D.'s, Four Nurses, all Agents and Techniques. Modernization program going on. Two and one-half hours from Boston & New York. Write G. J. Carroll, M.D., William W. Backus Hospital, Norwich, Connecticut.

NURSE ANESTHETIST: New 150 bed hospital, ideally located on Lake Erie. Plans for expansion in near future. Excellent working conditions. Apply, including telephone number to: H. A. Tagett, M.D., Anesthesiologist, Ashtabula General Hospital, Ashtabula, Ohio.

NURSE ANESTHETIST - 125 bed General Hospital, Southeastern Massachusetts to work with Anesthesiologist. Salary, etc. open, depending on training and experience. Write: William H. Lewis, M.D., 376 Tremont St., Taunton, Mass.

WANTED: Nurse Anesthetist - Director of Nurses. 26 bed General Hospital. College Town. No O.B. Salary $500 to $600 per month. Apply Administrator, Crete Municipal Hospital, Crete, Nebraska.

WANTED - Relief Anesthetist for 4 to 6 weeks beginning July 15 or earlier. 60 bed general hospital. Call time shared with another anesthetist. $450 a month with full maintenance, or $500 a month without. Call or write Donald Showman, Kennedy Deaconess Hospital, Havre, Montana. Phone 113.

TWO (2) ANESTHETISTS. 275 bed hospital. Start $475.00 per month and full maintenance. Emergency call every fourth day. Department directed by Anesthesiologists. Apply St. Francis Hospital, Monroe, Louisiana.

Lutheran Deaconess Hospital, a 200 bed general hospital located on the near Northwest side of Chicago is in need of an Anesthetist for a permanent, full time position beginning July 1, 1959. For details write to the Executive Director, Lutheran Deaconess Hospital, 1138 N. Leavitt St., Chicago 22, Illinois.

WANTED - Nurse Anesthetist for group headed by 2 M.D.'s with 3 nurses at present. Paid vacations and sick leave. Salary dependent upon experience. Contact Drs. Ambler & Hoskins, 203 Doctors Bldg., Asheville, North Carolina.

DELAWARE — Modern, air-conditioned, 310 bed hospital, 30 miles from Philadelphia, Pennsylvania. Staff, 3 physicians, 3 nurses; Live in or out. Usually off duty by 2:00 p.m. unless on call. Call every 3rd night and week-end with each following day off. Only nurse on week-end works Saturday. One month vacation plus 7-10 days holiday time. All types Surgery; all agents and methods. Will teach if not familiar. Pay $500.00 if R.N.A. depending upon experience; yearly increases. Write K. S. Russell, M.D., Wilmington General Hospital, Wilmington, Delaware.

WANTED - Nurse Anesthetist, male or female. 100 bed modern hospital expanding to 150 beds, located in Columbia, Tennessee, which is 40 miles South of Nashville (20,000 population). Base salary $480 per month, $10 per case for each case started after 3:00 p.m. Monday through Friday, all emergency cases Saturday and Sunday. Minimum monthly guarantee $560. Average monthly earnings $600. Three weeks vacation, six holidays, Social Security and laundry of uniforms. For further details, contact W. B. Barnhart, Administrator, Maury County Hospital, Columbia, Tennessee.

NURSE ANESTHETIST, Alaska; salary $575.00 mo. (2) Southern hosp. offers $7000.00 ann. for qualified reg. anes.
NURSE ANESTHETIST, Ob. and Surg. anesthesia. No call, some occasional night relief. $367.47 to $447.20. Ohio.
NURSE ANESTHETIST, Washington. 40 hour week. $500.00 per month.
NURSE ANESTHETIST, 150-175 bed North Carolina hospital. Salary open. Pleasant working conditions.

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WANTED—Nurse Anesthetist. Modern 28 bed general hospital in attractive growing community in the foothills of the Cascade mountains. Salary open. Contact: Superintendent, Community Memorial Hospital, Enumclaw, Washington.

NURSE ANESTHETIST. New 50-bed hospital; excellent working conditions and personnel policies. Contact: Administrator, Dearborn County Hospital, P. O. Box 72, Lawrenceburg, Indiana.

NURSE ANESTHETIST for fully accredited, expanding hospital in beautiful Northern Michigan. Member or eligible for AANA. Salary—begin new graduate at $450 per month—open for experienced anesthetist. Five day week, annual vacation, sick leave, social security, hospital group life insurance. Apply: A. J. Hegener, M.D., Little Traverse Hospital, Petoskey, Michigan.

NURSE ANESTHETISTS. Permanent position in small hospital. Anesthesia staff of three. Light call work. Upper Midwest location. Salary $425 plus vacation, sick leave, and hospitalization benefits. J. C. A. H. approved hospital. Write Box M-35, Journal American Association of Nurse Anesthetists, Prudential Plaza, Suite 3010, Chicago 1, Illinois.

REGISTERED NURSE ANESTHETIST. Member of 10 nurse team for large, new operating pavilion. Latest equipment and procedures used for regular and developmental surgery. No recovery or constant care duties. 5 day, 40 hour week plus exceptional benefits. Salary based on experience and subject to merit review. Apply: J. T. Hutson, Personnel Director, Cleveland Clinic Hospital, 2020 E. 93rd St., Cleveland 6, Ohio.

TWO NURSE ANESTHETISTS for 390 bed General Medical and Surgical Hospital. One full time M.D. Anesthesiologist on duty. 173 active surgical beds. New operating room suite and equipment. Contact Director, Professional Services, Veterans Administration Hospital, Muskogee, Oklahoma.

NURSE ANESTHETIST—New air-conditioned surgical and anesthesia suite. 75 beds, fully accredited. Full maintenance, excellent salary, liberal vacation and other benefits. Apply Administrator, Riverview Memorial Hospital, St. Paul, Minnesota.

NURSE ANESTHETIST. 134 bed General Hospital with psychiatric unit. Fully accredited hospital conveniently located to downtown St. Paul. In addition to cash salary the following benefits are provided: Blue Cross-Blue Shield, laundry of uniforms, board, sick leave, seven holidays, and four weeks vacation. Complete maintenance available if desired. For additional information write: Esther M. Garnett, R.N., Superintendent, Mounds Park Hospital, 200 Earl Street, St. Paul 6, Minnesota.

REGISTERED NURSE ANESTHETIST for modern, 45 bed General Hospital, Southeastern Washington. Salary open. Write: Administrator, Kennewick General Hospital, Kennewick, Washington.

The THIRTIETH QUALIFYING EXAMINATION for membership in the American Association of Nurse Anesthetists will be conducted on November 14, 1959. The deadline for accepting completed applications including the transcripts is October 5. Notice of eligibility will be mailed about October 12.

Applications should be forwarded early enough to allow time to request transcripts and have them returned to the Executive Office before the deadline date.

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